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PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

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SANITATION,
BRIDGES.

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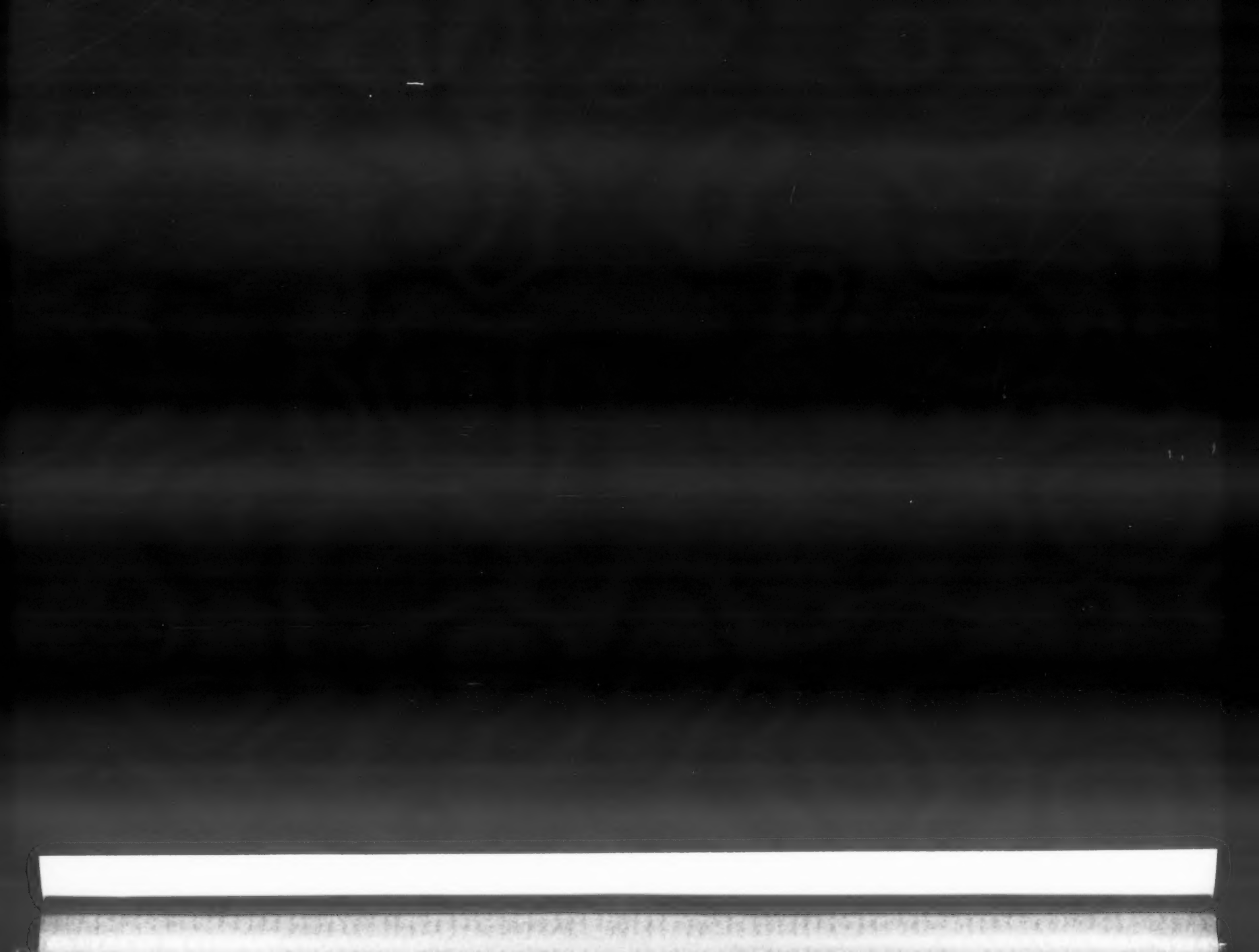
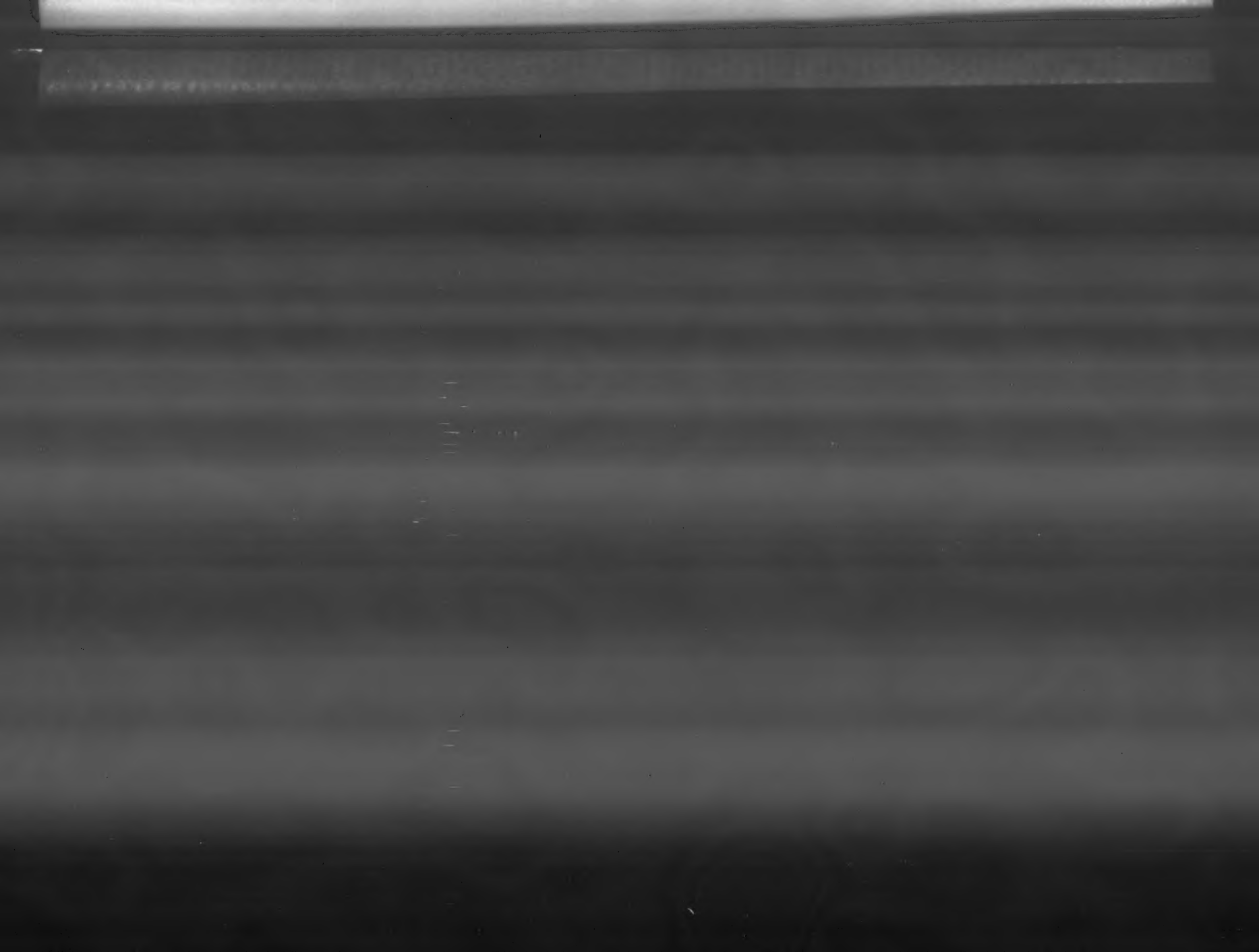




Municipal Engineering

VOLUME XVIII. MAY, NINETEEN HUNDRED. NUMBER 5.

ASPHALT PAVING TESTS.

By F. E. Puffer, A. B.

Some years ago the testing of materials entering into the construction of municipal public work was seldom undertaken by the city's regular engineering corps. Reliance was then placed largely on the tests of manufacturers and the general reputation of the various brands of material. At the present time, however, almost all cities have some sort of a laboratory of their own, where at least simple tests are carried on. This is particularly true in the case of brick and cement—in fact, particular brands of these materials are seldom specified now, and reliance is placed largely by every city on its own tests.

In the case of asphalt paving materials, while names of brands have been generally omitted from specifications, few cities have tests made in their own laboratories, but generally rely on the skill of contractors for the quality of their pavements.

It is the object of this article to explain certain simple tests of asphalt paving materials that may safely be undertaken by city engineers in their laboratories. Any employe skillful enough to make cement tests may be relied on, after a few trials, to make these tests accurately, and a record of these tests running over a term of years will be very valuable in the construction of new pavements.

Test for bitumen in pavement mixture.—The apparatus required are a chemical balance, some large test tubes, say about eight inches long and one inch diameter, an alcohol or gas lamp, and some carbon bisulphide. By using large amounts of paving mixture, say ten grams or more, the errors of unskillful manipulation are largely eliminated, and an inexpensive chemical balance is sufficiently accurate. To make the test, place the sample of paving mixture, after weighing, in a test tube previously weighed. Fill nearly to the top with carbon bisulphide. Fit tight cork stopper to tube, and after agitating gently until material appears dissolved, lay away for a day in a nearly horizontal position, then pour off carefully the carbon bisulphide with the dissolved bitumen. Evaporate the rest of the solvent over a lamp; weigh tube and the dry organic matter, and the difference in weight between this and weight of tube and sample previously obtained is the bitumen dissolved, from which percentage of bitumen is readily obtained.

Tests for asphalt cement.—(1) Penetration. The oldest and per-

haps most reliable test of hardness or viscosity of asphalt cement is the penetration test. These tests, so far as I know, have not been brought to a standard previous to the investigations of Mr. Dow. Mr. Dow's standard of depth, measured in millimeters penetrated by a No. 2 needle, pressing with weight of one hundred grams for five seconds on sample of asphalt cement at a temperature of 77° F., gives a standard by which tests made by different persons on different machines can be standardized.

(2) Tube test for hardness. This test, which, I believe, was first used by Mr. Bienenfield, requires less apparatus than the penetration test. To make the test take a one-fourth-inch glass tube about six inches long, insert a plug of asphalt cement in tube about an inch from the end; this plug, when pressed in place by a glass rod inserted in each end of tube, the tube being previously wet, should be a quarter of an inch long; the quantity of asphalt necessary to fill quarter-inch space in tube after being ascertained by experiment can be regulated by weight. Place tube, plug end down, in beaker of water over an alcohol lamp. Have immersed end of tube a definite distance below surface of water—say four inches. Place thermometer in beaker to register temperature. Light lamp. As temperature increases to something over 100° F. the plug of cement will break, accompanied by a slight explosive sound. Temperature at which breaking occurs indicates temper of cement, breaking temperature increasing with hardness or viscosity of cement. This test is accurate and easily made. It is open to the objection, however, that the test is made at a higher temperature than that at which it is desirable to know the hardness of the cement.

Tests for fineness of inorganic particles.—(Sand and stone dust.) A set of brass screens, numbered, respectively, 20, 40, 60, 80, 100 and 200, the numbers indicating number of meshes per lineal inch, and a pair of druggist's scales capable of weighing a pound, are all the apparatus necessary to this test. The amount of material, sand or dust, that is caught on each screen is noted and the result tabulated in percentages.

The three tests above described are the most important elementary tests of the ingredients of an asphalt paving mixture. The tests should be taken at regular intervals, daily, if possible, whenever an asphalt pavement is being laid; a sample like that tested should be filed away for future reference, and the results of tests entered in a book and made a permanent record. The value of this record, perhaps, may not be apparent at once, but after a few years its value would be plain. The relation between percentage of bitumen, softness of cement and fineness of sand will soon be apparent. When the pavements of whose mixtures these tests have been recorded are old enough, so that some of them begin to show signs of weakness of a definite sort, a reference to the record and samples would give valuable evidence as to the cause of the trouble.

Of course these tests do not give all the information that is to be desired. They throw no light on the most important question of all—the life and durability of the asphalt cement itself, whether it is composed of stable compounds or not. After a number of years' records have been obtained, however, even

the stability of the asphalt cement would be shown in a negative way. That is, a pavement having about the same tests for bitumen, temper of cement and graduation of inorganic particles, the one that appears to retain its life and malleability under traffic for the longest period would be the one made of the most stable asphalt cement.

MUNICIPAL LIGHT, HEAT AND POWER.

By Alton D. Adams, M. A. I. E. E.

Among the most important problems with which towns and cities have to deal is the supply of light, heat and power in cheap and convenient forms for public and private use. It may be pointed out at the start that questions as to the best forms of energy for general use are in no way necessarily connected with either public or private ownership, as a community may, by suitable contracts, determine the kinds and qualities of service to be rendered by corporations and also the rate of dividends they may pay on invested capital. Thus far, more attention has been given and better results secured in the public supply of light than for that of heat and power. At the present time both gas and electric energy are generally distributed for light, heat and power purposes, but the extent of the application of each to these several uses is by no means equal, nor is the efficiency of either agent uniform for the three kinds of work. As both gas and electric energy are derived from coal, a comparison of their results in light, heat and power production with the total heat of the fuel consumed is of practical importance.

Taking, first, the matter of electric energy from a steam-driven plant with boilers of the best class, compound condensing engines and standard electric generators, the efficiency of boiler plant is about 75, the engines 14, and the dynamos 90 per cent., giving the combination $75 \times .14 \times .90 = 8.5$ per cent. efficienty. In other words, 8.5 parts in the hundred of the heat from the combustion of coal are delivered to distribution lines as electric energy. A 16-candle power incandescent lamp of the most common efficiency consumes 56 or 57 watts per hour, and, as the watt is 1–746 part of the horse-power, about 13, $=746 \div 56$, lamps are supplied per electrical horse-power hour of delivered energy, if the loss in lines be neglected. The electrical, like the mechanical horse-power hour, does work to the equivalent of 2,545 heat units, a heat unit being the amount necessary to raise one pound of water one degree Farenheit in temperature. A single 16-candle power incandescent lamp, therefore, dissipates $2,545 \div 13 = 196$ heat units per hour. Since electrical energy delivered at the dynamo terminals represents only 8.5 per cent. of the heat produced by the combustion of coal, the operation of one 16-candle power incandescent lamp during one hour required that $196 \div .085 = 2,306$ heat units be developed in the boiler furnace. Allowing the total heat liberated by the complete combustion of one pound of coal to be 13,000 heat units, $2,306 \div 13,000 = .18$ of a pound of coal must be burned per lamp hour.

Any kind of artificial light repre-

sents but a minute part, usually less than one per cent. of the energy expended at the lamp to produce it, but comparisons here made concern the amount of energy in different forms consumed for a certain amount of light, rather than the ratio of light energy to the heat by which it is developed. Electric arc lamps yield from three to four times the amount of light, per unit of energy consumed, as do the incandescent, but it has not thus been found practicable to operate the electric arc for lamps of but few candle power, like those of the incandescent type in general use.

Electric heaters are perfect in efficiency, that is, they yield as heat the equivalent of all the electric energy that they consume. In spite of this high efficiency, there is no prospect that electric heaters can have any extended use for general purposes, so long as electric energy is mainly derived from dynamos, driven by steam engines, because, as shown, the dynamo output represents only about 8.5 per cent. of the energy of coal consumed, and because the cost of steam and electric equipment is too great per unit of heat delivered.

Electric heaters, of small capacity and for special purposes, have many and varied applications in industrial operations, but are of slight importance for general heat in buildings. For the supply of small motive powers, electric energy is at a much greater advantage than in the distribution of heat.

Devices for general heating, directly by the combustion of coal, range in efficiency from 25 per cent. for the ordinary stove to 75 per cent. for a first-class boiler and steam-heating plant, against the 8.5 per cent. of electric heaters. Electric motors, in ordinary sizes, range in efficiency from 75 to 90 per cent., and may, therefore, be expected to deliver, on the average, about $8.5 \times .80 = 6.8$ per cent. of the energy generated by the complete combustion of coal. High-grade steam-power plants, working under favorable conditions, deliver about $75 \times .14 = 10.5$ per cent. of the energy from coal, as mechanical motion at the engine shafts; but in plants of small and medium size, with the average conditions of load and quality of equipment, the actual efficiency often falls to one-half or even one-quarter of this figure. As one-horse power hour is the equivalent of 2,545 heat units, a total efficiency of 10.5 per cent. for the steam power plant implies the development of $2,545 \div .105 = 24,238$ heat units in the boiler furnace for each horse power hour delivered at the engine shaft. With coal that yields 13,000 heat units per pound on complete combustion, as above, the necessary weight is $24,238 \div 13,000 = 1.86$ pounds per brake horse power hour.

As a matter of practice it is well known that small and medium steam plants generally consume from four to ten pounds of coal per horse power hour delivered. Allowing, per above figures, that electric motors deliver as mechanical work about 6.8 per cent. of the energy in coal consumed for their operation, one horse power hour, developed by the electric motor, requires that $2,545 \div 6.8 = 37,427$ heat units be generated in the boiler furnace. For each horse power hour delivered by the electric motor, $37,427 \div 13,000 = 2.88$ pounds of coal must, therefore, be consumed.

The great differences practicable, in fuel economy, between large and small steam power plants, together with the savings effected in room and labor of attention, by electric motors, warrants their

extending supply from central station mains for small powers. Where enough power is wanted, however, to warrant first-class steam equipment and skilled attention, it is obviously uneconomical to incur central station rates that must include large items for fixed charges on electric lines and machinery, as well as extra labor and some profit, while they have no advantage in economy of fuel and must lose some energy in transportation and distribution. Desirable, therefore, as is electrical power from central stations for small users, it offers no advantages where very large power units must be had in one place for either public or private use.

Two kinds of gas are generally distributed for light, heat and power purposes. The older kind of gas and that more commonly produced in small towns is derived entirely from coal heated in retorts, nearly to the point of whiteness. Gases distilled from coal, in this way, contain about one-fourth of the coal's total heating power, or, in other words, one ton of coal yields about 10,000 cubic feet of gas, containing 650 heat units per cubic foot, a total of 6,500,000 heat units from 2,000 pounds of coal. Allowing 13,000 heat units as the total heating capacity per pound of coal, the heat per ton is $13,000 \times 2,000 = 26,000,000$ units, so that the heating power of the gas obtained per ton is $6,500,000 \div 26,000,000 = .25$ of that in the coal used. In the production of coal-gas, the coal is not entirely consumed, each ton yielding, besides the gas, from 1,200 to 1,400 pounds of coke, 140 pounds of tar and 220 pounds of ammonia liquor. About 300 pounds of coke are required to heat retorts for the reduction of one ton of coal to gas, coke, tar and ammonia liquor, leaving a net product of about 1,000 pounds of coke per ton of coal used. This coke has a heating capacity per pound nearly equal to that of the coal.

Water-gas is made by forcing steam through a bed of incandescent fuel, and contains only one-half of the heating power of the coal consumed. The heat units per cubic foot in pure water-gas are about 325, and it has no value for illuminating purposes until treated with hydrocarbonate vapors, which latter are usually obtained from petroleum. These vapors are usually added until the water-gas attains a heating capacity of 650 or 700 per cubic foot, and has a power of illumination equal to, or even greater, than the best coal-gas. It should be noted that fully one-half of the heat energy in water-gas, when the hydrocarbon vapors have been added, is derived from petroleum, and the cost of its production must depend largely on the price of mineral oil. The water-gas process derives no valuable product from the coal except gas, and the heat energy of the gas, compared with that of the coal used, represents the efficiency of the process. The coke produced with coal-gas may be, and in some cases is, used to generate water-gas, instead of coal. Taking the net product of coke per ton of coal treated for coal-gas, to have one-half of the coal's heat energy, the water-gas process applied to this coke yields gas with one-fourth of the heating power of the original amount of coal. So that, as the coal-gas obtained has one-fourth, and the water-gas, derived from the coke, another fourth of the heat units in the coal used, the net result, as to gas, includes one-half of the coal's energy, or about the same

proportion that is secured where all of the coal is treated for water-gas at the start. It may thus be fairly considered that both coal and water-gas contain one-half of the heating power of the coal that is totally consumed for gas production.

As it is desired here to reduce the effects of gas in light, heat and power production to terms of the original coal, and as petroleum is a more expensive fuel than coal, gas is treated as purely a substance from the latter, as it really is in coal gas. A gas burner that consumes five cubic feet of gas is usually considered to give about the same amount of light as a 16-candle-power, 56 watt, electric lamp. Five cubic feet of gas yields on combustion $650 \times 5 = 3{,}250$ heat units, and represent coal having $3{,}250 \times 2 = 6{,}500$ heat units, since gas contains one-half of the heat in coal used to produce it by usual methods. Compared with these figures for coal consumed and heat given off in gas lighting, the 16-candle-power incandescent lamp, as shown above, consumes electric energy to the amount of only 196 heat units per hour or $196 \div 3{,}250 = .06$ of the heat expended at a gas jet in the same time. In spite, moreover, of the very low combined efficiency of boilers, engines and dynamos, the electric lamp requires for its hourly operation, but .18 of a pound of coal in the boiler furnace, instead of $6{,}500 \div 13{,}000 = .5$ of a pound that must be consumed at the gas plant to support a gas jet for one hour. Thus while electric energy represents but 8.5 per cent. of the heat of the coal consumed in its production, instead of 50 per cent. as in the case of gas, yet so much more efficient is the electric lamp than the gas jet that the coal consumed to supply the former is only $.18 \div .5 = .36$ of that required by the latter for the same lighting effect.

When used for general heating purposes, gas has a great advantage over electric energy, because, while electric currents can deliver only about 8.5 per cent. of the heat from coal, the gas brings 50 per cent. of the coal's heating power to the place of use. If all of the heat from gas combustion could be applied to any desired object, heating with gas would require the consumption of $.085 \div .5 = .17$ of the coal necessary to heat with electric current; but some of the heat from gas must usually escape in chimney gases, and, allowing one-fourth of the heat to escape in this way, the consumption of coal is still $(.5 \times .75) \div (.085) = 4.4$ times as great for electric as for gas heat.

Viewed from the fuel standpoint, therefore, the place of gas in public supply is that of a heating rather than a lighting agent. For purposes of power production, gas has proved to be a more satisfactory vehicle of heat energy than steam, because, while the steam engine, at best, delivers in mechanical work but 14 to 16 per cent. of the heat energy, in the steam it consumes, gas engines show efficiencies, as to the heat of gas entering them, of from 20 per cent., in small, to 25 per cent. in large sizes, by delivered power at shafts. At the lower of these efficiencies, a gas engine delivers, for mechanical work, $.50 \times .20 = .10$ of the energy of coal, instead of 6.8 per cent. by electric motors.

While electric motors, under the most favorable conditions at the generating plant, make necessary the consumption of 2.88 pounds of coal for each horse power hour given off at the motor shaft, gas engines in small sizes supply a brake

horse power hour on a quantity of gas containing $2,545 \div .20 = 12,725$ heat units, and, since gas has one-half of the heat energy of the coal from which it is produced, the heat in coal required to form this gas is $12,750 \div .5 = 25,450$ heat units and the weight equals $25,450 \div 13,000 = 1.96$ pound per delivered horse power hour, or about two-thirds of that for electric motors. With large gas engines of several hundred horse power capacity, as much as $.50 \times .25 = .125$ of the energy of coal may be delivered as mechanical power. Stoves and small heating furnaces and boilers usually yield from one-fourth to one-half of the heating power of coal, the remainder being lost through imperfect combustion and the high temperature of chimney gases. Most steam power plants under fifty horse power capacity use as much as five and many as much as ten pounds of coal per delivered horse power hour.

From the showing just made for the ordinary forms of gas, that is, $(.50 \times .75) = .375$ of the total energy of coal available as gas heat, and one horse power hour supplied by the gas engine for the consumption of 1.96 pounds of coal at the gas works, it seems evident that the extensive distribution of gas for heat and power purposes, at suitable prices, would be of great advantage in most communities. Fortunately, however, the availability of gas as a general power and heating agent does not rest on the efficiency of the more commonly used processes of gas production.

While the water-gas process alone or its combination with that for coal-gas yield only about one-half of the heat energy in coal, what is known as producer gas is now made, by a process simpler than the others, and contains 80 per cent. of coal's energy. Producer gas is made by a method that may be carried on with as little interruption as desired, from the finest sizes and cheapest grades of coal or coke. Allowing, as above, that one-fourth of the heat from gas fuel is wasted, producer gas still yields a useful effect equal to $80 \times .75 = 60$ per cent. of coal's energy, or about twice that from the ordinary stove. With gas engines of 20 per cent. efficiency, the gas consumed per horse power hour contains $2,545 \div .20 = 12,725$ heat units and requires $(12,725 \div .80) \div 13,000 = 1.22$ pounds of coal for its production. Producer gas for heat and power only can probably be distributed at a price that will give a unit of energy for less than one-quarter what it now generally costs from the gas mains.

The future ideal municipal supply of energy will employ electricity for lighting and very small motors, and gas for the production of large mechanical powers and general heating purposes.

FILTRATION PLANT FOR THE ALBANY WATER SUPPLY.

The water supply of the city of Albany, which was originally obtained by gravity from certain reservoirs on small streams to the west and north of the city, was, says the *Scientific American*, augmented in 1873 by taking water from the Hudson river through an intake in the river, opposite the heart of the city. In recent years the amount of water drawn from this source has greatly exceeded that obtained from the reservoirs above mentioned. At low water stages, owing to the tidal currents, considerable sewage is carried up-

stream to the intake, and the sewage of the city was thus present in a very considerable amount in its own water supply. In addition to the local source of pollution the river received the sewage of Troy, Schenectady, Utica, Rome and many other towns further up the river. Under such conditions it is not surprising that the death rate in Albany was excessive.

As a result of the investigation by the water board made in 1896 by its superintendent, Mr. George I. Bailey, C. E., and by Mr. Allen Hazen, C. E., a report was presented in February, 1897, which recommended that the present intake be abandoned, a new one established about two miles further up the river, clear of the local source of pollution, and a filtration plant established at that point. This important work has been carried through and forms the subject of the accompanying illustrations.

Source of supply.—The Hudson river at the point of the intake has a drainage area of 8,240 square miles; the average annual flow of the streams amounts to at least 1,000,000 gallons per square mile per day, or over 8,000,000,000 gallons per day, while the minimum flow is only a small fraction of this amount. The minimum flow of the Hudson at Albany is about 1,060,000,000 gallons per twenty-four hours. This is about a hundred times the average amount of water taken from the river for waterworks purposes. The Hudson river opposite the filtration works flows in two channels, which are formed by a long, narrow island. The main channel of the river, which formerly flowed between the island and the city, has now been diverted to the other channel as the result of the construction of a dike by the United States government to improve navigation. The investiga-

THE SAND-WASHING APPARATUS.

tion of the water showed that that in the back channel was considerably better than the water in the main channel, and the intake was accordingly located in the former. The intake consists of a simple concrete structure in the form of a box with an open top covered with rails placed 6 inches apart, and from the box a 36-inch pipe leads to a well in the pumping station. Before going to the pumps the water passes through a screen with bars 2 inches apart. The centrifugal pumps at the pumping station have a guaranteed capacity of 16,000,000 gallons per twenty-four hours against a lift of 18 feet, or of 12,000,000 gallons per twenty-four hours against a lift of 24 feet. The pumping station building, to a point above the highest flood level, is of massive concrete construction without any openings. Upon leaving the pumping station the water passes through a 36-inch Venturi meter, which records the quantity of water pumped, and is also arranged to show on gauges in the pumping station the rate of the pumping.

Aeration.—After leaving the meter the water passes to the sedimentation basin through eleven outlets, which consist of 12-inch pipes stood on end, the tops of which are 4 feet above the nominal flow-line of the sedimentation basin. Each of these outlet pipes is pierced with 296 ¾ inch holes, extending from 6 inches to 3 feet 6 inches below the top of the pipe. The area of these holes is so computed that when 11,000,000 gallons of water per day are pumped all the water will pass through the holes, the water in the pipes rising until it is just flush with the tops. The water is thus thrown out in 3,256 small streams and becomes thoroughly aerated. When more than the above amount is pumped the excess flows over the

PLACING THE GROINED CONCRETE FLOOR OF A FILTER.

tops of the outlet pipes in thin sheets, which are broken up by the jets. Although no observations have been taken on the Hudson river, experience with the Merrimac at Lawrence, where the conditions are in many respects similar, shows that since the water is at all times more or less aerated, and during the greater part of the year is nearly saturated with oxygen, aeration is not necessary. During low

INTERIOR OF A FILTER, SHOWING THE LAYERS OF GRAVEL AND SAND.

water, in the summer season, however, there is much less oxygen in the water, and at these times aeration is a distinct advantage. Another advantage of aeration is that it tends to remove the slight odor which is liable to exist in river water.

Sedimentation basin.—From the outlets the water falls into a large basin measuring 382½x600 feet, which is located with its longer side approximately parallel to the banks of the river. The basin has an area of 5 acres, and is 9 feet in depth. To the overflow line it has a capacity of 14,600,000 gallons, and to the flow line of the filters 8,900,000, the reserve capacity being, therefore, 5,700,000 gallons. The basin, which is close to the river bank, is built largely above the natural surface of the soil. The embankments are made of the clay obtained in excavating the filters, mixed with gravel from the river, these materials being put down in alternating layers and well rolled. The outside of the embankment is covered with soil, the inside and bottom is 16 inches of puddle, which is protected from frost on the sides by a covering of gravel, above which is a rough bluestone pavement.

The water enters the sedimentation basin from eleven inlets along one side, and is drawn out from eleven inlets directly opposite. The floor of the basin is built with even

slopes from the toe of each embankment to a sump, from which a 24-inch pipe leads to a large man-hole in which there is a gate through which the water can be drawn, in emptying the basin.

The Filters.—The filters, which are built of masonry, are covered to protect them from the severity of the winter weather. The piers, cross-walls and linings of the outer walls, entrances, etc., are of vitrified brick, while all other masonry is concrete. The average depth of the excavation for the filters was 4 feet. The floors consist of inverted, groined, concrete arches, arranged to distribute the weight of the walls and vaulting over the whole area of the bottom. The bottoms were put in alternate squares, running diagonally with the pier lines, as shown in the accompanying illustration. The vaulting was designed with a clear span of 12 feet, a rise of 2½ feet and thickness of 6 inches at the crown. Above the vaulting there are 2 feet of earth and soil, grassed on the top. The tops of the man-holes are carried 6 inches above the soil to prevent the entrance of rain water. The man-holes of the filters are provided with double covers of steel plates to exclude the cold.

The Underdrains.—At the bottom of the floor of the filters, between each line of piers, is a line of transverse 6-inch vitrified pipe collectors, laid with open joints, which connect with a main underdrain, laid beneath the floor of the filter and extending throughout its whole length, as shown in the accompanying plan. The main drains were put in before the construction of the filters was commenced. They are entirely surrounded with concrete. The main effluent collectors are 30-inch vitrified pipes reduced to 20-inches at the outlets.

BUILDING THE BRICK PIERS.

Filter Gravel.—The gravel surrounding the under drains is of

three grades. A coarse grade of gravel of from 1 to 2 inches diameter is laid immediately over the six-inch drains; the second grade which is laid immediately above it is from about ⅜ of an inch to 1 inch in diameter, while the finest gravel forms a third layer whose grains are from 3-16 to ⅜ of an inch in diameter.

The coarse gravel entirely surrounds the 6-inch pipe drains and is carried slightly above their tops. The second grade fills up all the spaces on the floor to within 2½ inches of the finished surface of the gravel; the finest grade being applied in a layer which is about 2½ inches deep. Above the gravel is placed a layer of sand 4 feet deep. The specifications for this sand require that it shall be clean, river, beach or bank sand with either sharp or rounded grains, that it shall be free from clay, dust or organic impurities. The sand has effective sizes averaging 0.31 millimeter.

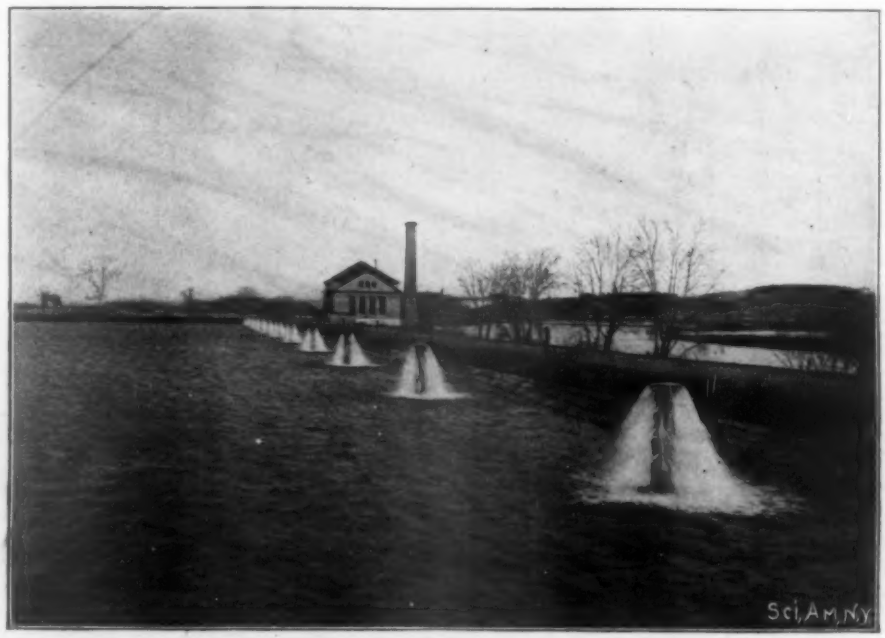
Most of the suspended matters in the filtered waters are held by the top layer of sand which is removed from time to time. The dirty sand is washed and eventually replaced in the filters. Two ejector sand-washing machines, of the type shown in the drawings, are provided at convenient places between the filters. In them the dirty sand is mixed with water and is thrown up by an ejector, after which it runs through a chute into a receptacle from which it is again lifted by another ejector. It passes altogether through five ejectors, a part of the dirty water being wasted each time. The sand is finally collected from the last ejector where it is allowed to deposit from the water.

CONSTRUCTING THE VAULTED ROOF OF FILTERS.

The cost of this filtration plant was for the sedimentation basin $60,000, for the pure water reservoir in which the filtered water is

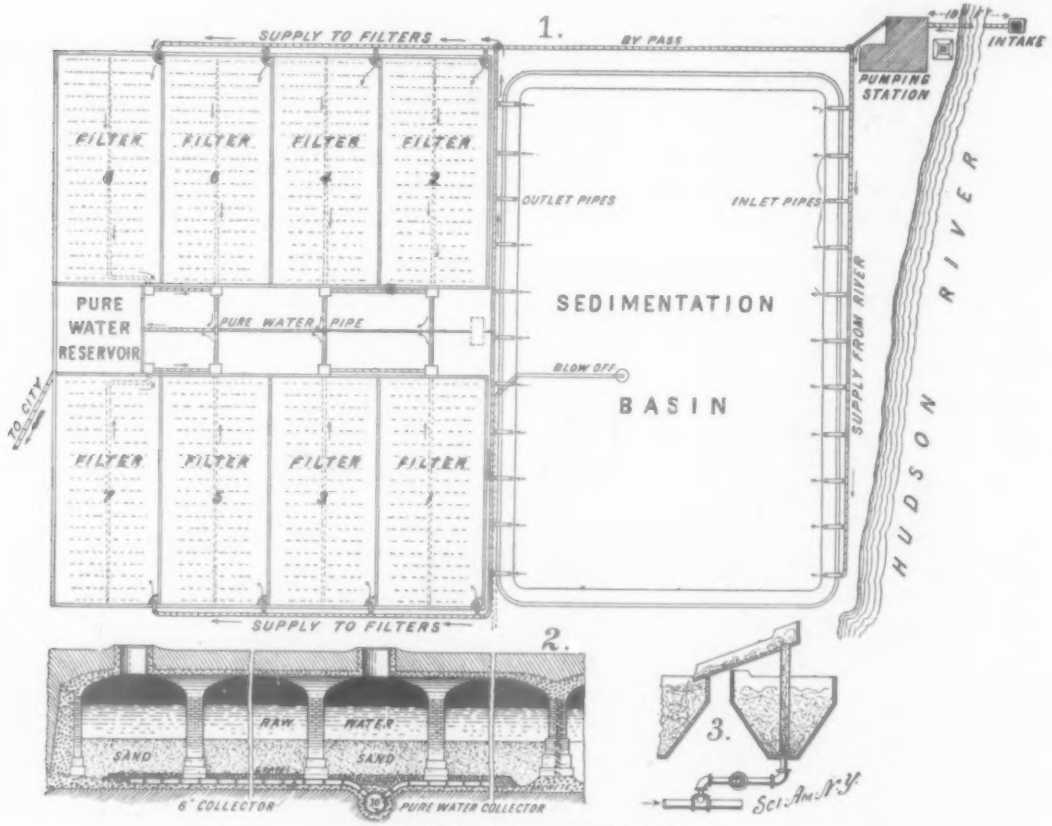
collected before going to the city, $9,000, and for the filters $255,000. The complete filters, including the piping, cost $45,000 per acre of net filtering area, exclusive of the land and engineering.

Results of operation.—The filters were designed to remove from the water the bacteria which causes disease. They have already reached a bacterial efficiency of over 99 per cent. The disease directly traceable to the sewer-polluted waters of the Hudson was typhoid fever, the death rate from which in the city of Albany had been large, the average number of deaths from this cause for nine years, ending 1898, being 85 per annum. During the first four months in which the filters were in operation seven deaths from this cause have been reported. For the corresponding time for the nine years ending 1898, the average number of deaths was 24, so that the filtration of the water has reduced the deaths from this cause in the ratio of 24 to 7. The St. Lawrence filtration plant has reduced the typhoid fever rate from 11.31 to 2.54. The filtration plant of the city of Hamburg, Germany, was put in operation in 1895, and for the five years previous to that date the average typhoid fever rate was 4.72, and subsequently to that date it has fallen to 0.72. The filtration plant of the city of Mount Vernon, N. Y., was opened in 1894, since which date the number of deaths from typhoid decreased over 76 per cent. The cost of operation of the whole plant, as shown by figures furnished by Mr. George J. Bailey, the superintendent of the works, was $6,165 for the period September 5 to December 25, of last year. This included the pay-roll, tools, repairs, supplies, etc. In this period 1,470,000,000 gallons were filtered, the average cost per million gallons being therefore $4.19.



SEDIMENTATION BASIN, SHOWING AERATING OUTLETS AND PUMPING STATION.

The average cost per million gallons of the operation of the pumping stations was $2.52, leaving $1.67 to represent the cost of operating the filters, including the laboratory work.



THE ALBANY FILTRATION PLANT.

1. General Plan. 2. Section through Filter. 3. Detail of Sand Washing Machine.

OUTLOOK FOR PUBLIC WORK.

City officials throughout the country have sent reports to MUNICIPAL ENGINEERING in the last two weeks of April regarding public work contemplated during the current year, except in the large cities, where definite information can not be furnished at this time, and also in many of the smaller cities and towns, where plans for the year have not yet developed. In some instances the reports relate to contemplated work, but in the majority of cities they cover only the work authorized or already under contract. Recent court decisions, adverse to existing methods of assessment, have affected public improvements in some of the states, where, in consequence, much contemplated work is held in suspense. A tabulation of the definite reports from the smaller cities shows that there will be an unusual amount of brick paving and pipe sewer construction. There is, on the other

hand, less of water main extension. An unusually large number of the smaller cities have under consideration asphalt paving, but in many of them a determination has not yet been reached as to just what will be done. The contemplated macadam and telford paving consists largely of the usual work done by cities by day labor.

SOME OF THE PUBLIC WORK TO BE DONE IN 1900.

CITIES.	Asphalt.		Brick.		Macadam, Telford.		Sewers.	
	Sq. Yards.	Est. Cost.	Sq. Yards.	Est. Cost.	Sq. Yards.	Est. Cost.	Brick. Lin. Ft.	Pipe. Lin. Ft.
Akron, Ohio	38,117	$132,756	.....	.....	.....	.....	.....	.....
Alton, Ill	.....	.....	.....	.....	.....	$24,000	.....	2,400
Altoona, Pa	.....	.....	4,000	.....	.....	.....	.....	20,000
Amsterdam, N. Y	6,000	17,105	6,000	12,318	.....	.....	.....	900
Ann Arbor, Mich	.....	.....	11,168	29,492	.....	.....	.....	.....
Bangor, Me	.....	.....	.....	.....	5,000	.....	.....	.....
Bay City, Mich	.....	.....	20,000	35,000	.....	.....	2,024	.....
Beaver Falls, Pa	.....	.....	12,000	.....	.....	.....	.....	.....
Bridgeton, N. J	.....	.....	.....	.....	.....	.....	.....	1,000
Butte, Mont	.....	.....	.....	.....	.....	.....	300	4,500
Canton, Ohio	.....	.....	40,000	38,000	.....	.....	.....	10,000
Cedar Rapids, Iowa	.....	.....	.....	.....	.....	.....	1,000	1,500
Chillicothe, Ohio	.....	.....	16,000	28,000	.....	.....	.....	2,000
Cheyenne, Wyo	.....	.....	.....	.....	.....	.....	.....	5,000
Clinton, Iowa	.....	.....	.....	.....	4,000	.....	.....	.....
Columbus, Ga	.....	.....	5,000	9,000	.....	.....	150	.....
Cumberland, Md	.....	.....	15,400	.....	.....	.....	.....	7,900
Elgin, Ill	.....	.....	17,800	18,000	.....	.....	.....	.....
Flint, Mich	.....	.....	5,000	.....	5,000	.....	.....	.....
Fond du Lac, Wis	.....	.....	.....	.....	.....	.....	.....	7,000
Fort Smith, Ark	.....	.....	2,700	.....	6,000	.....	.....	.....
Galesburg, Ill	.....	.....	14,850	18,598	.....	.....	.....	20,580
Glens Falls, N. Y	Not	decid'd	Not	decid'd	.....	.....	.....	5,000
Green Bay, Wis	.....	.....	.....	.....	.....	.....	.....	1,200
Hornellsville, N. Y	.....	.....	5,000	10,000	.....	.....	.....	1,500
Jackson, Mich	.....	.....	.....	.....	.....	8,000	3,950	1,720
Joliet, Ill	20,000	60,000	4,200	8,000	.....	.....	6,000	2,000
LaCrosse, Wis	.....	.....	65,000	114,000	.....	.....	.....	1,000
Leavenworth, Kan	30,000	60,000	16,000	24,000	.....	.....	.....	.....
Lewiston, Me	.....	.....	.....	.....	.....	.....	.....	5,000
Macon, Ga	.....	.....	3,666	7,626	.....	.....	.....	.....
Manistee, Mich	.....	.....	.....	.....	.....	.....	.....	1,840
Marinette, Wis	.....	.....	18,000	.....	.....	.....	.....	.....
Meriden, Conn	.....	.....	.....	.....	.....	10,000	.....	14,000
Nashua, N. H	.....	.....	.....	.....	3,200	6,000	.....	.....
Nebraska City, Neb	.....	.....	13,000	18,000	.....	.....	.....	2,200
Norristown, Pa	.....	.....	.....	.....	.....	.....	.....	650
Plainfield, N. J	.....	.....	.....	.....	.....	15,000	.....	.....
Port Huron, Mich	.....	.....	.....	.....	40,000	28,000	.....	.....
Pueblo, Colo	.....	.....	.....	.....	.....	.....	.....	30,000
Rockford, Ill	.....	.....	.....	.....	25,000	.....	.....	10,560
Sandusky, Ohio	10,958	.....	.....	.....	.....	.....	.....	1,990
Shenandoah, Pa	.....	.....	4,800	9,000	.....	.....	.....	.....
Terre Haute, Ind	.....	.....	.....	.....	.....	.....	.....	4,000
Watertown, N. Y	.....	5,000	.....	.....	.....	.....	4,000	5,000
Williamsport, Pa	16,000	35,000	5,000	7,000	.....	.....	2,000	.....
Woonsocket, R. I	.....	.....	.....	.....	.....	.....	.....	7,000

In addition to the information set forth in the accompanying table information is noted in the reports from the different cities, as follows:

Altoona, Pa. (Harvey Linton, C. E.)— There is very little work probably to be done this year, excepting sewers and laying water pipe. Paving will depend upon petition of abutting property owners. About 4,000 square yards of vitrified brick pavement may be laid on Sixteenth street, but that is not yet decided. A plant is now established here for making vitrified paving brick. The material is of the best, and when the down-draft kilns are in working order we shall have A1 pavers. Mr. J. B. DeHaven is the manager. A city ordinance has been enacted which places the macadam paving to be done hereafter under the charge of the city engineer. The city engineer has been directed, by resolution of city council, to prepare plans and specifications for the disposal of the sewage of the eastern end of the city, amounting probably to about 2,000,000 gallons daily. One method of doing this is to convey this East End sewage by means of a tunnel under the city, to

the present fourth district intercepting sewer to Sugar Run, thence by a new conduit to the present filter beds. A considerable area would have to be added to these sewage filter beds. The problem is an interesting one.

Amsterdam, N. Y. (Francis E. Crane, C. E.)—In addition to asphalt and brick paving and sewer construction authorized, the city macadamizes different streets, working continuously throughout the season. Plans regarding water main extensions will not be known until after May 1.

Bay City, Mich. (George Turner, C. E.)—There is much work in contemplation, but nothing definite can be reported except on brick paving and brick sewers.

Clinton, Mass. (H. A. Thessell, C. E.)—Town has voted $5,000 for sewer extensions.

Clinton, Ia. (Chas. P. Chase, C. E.)—Year's work not yet laid out.

Dubuque, Ia. (E. C. Blake, C. E.)—A new council has just been elected and don't know what part of the contemplated work they will favor, as they have not had a meeting. May know later.

Fitchburg, Mass. (David A. Hartwell, C. E.)—Nothing definite has been settled upon.

Fond du Lac, Wis. (E. B. Parsons, C. E.)—Preparing plans for sewer system at North Fond du Lac, for the Fond du Lac Land Co. The system comprises about four miles, of which 1¼ miles is proposed to be built this season; 20 to 18-inch pipe to be used. No city work contemplated yet.

Gloucester, Mass. (W. L. Webber, C. E.)—City council will vote soon on question of issuing $200,000 for additional water supply.

Ishpeming, Mich. (P. H. Devine, Supt. of Public Works)—The estimates for season's work not yet made.

Johnstown, Pa. (Lee Masterson, C. E.)—City councils just reorganized, and it is a little early to have any idea of what will be done in the line of improvements.

Lewiston, Me.—The appropriations have not yet been made.

North Adams, Mass. (John Emigh, C. E.)—Probably some brick paving will be laid. Location and quantity undecided; probably $20,000 to $25,000 in tile sewers in various sizes by day labor.

Norwalk, Ct. (O. N. Wood, C. E.)—As yet nothing definite has transpired in any department. As soon as work is ordered will send you the facts.

Pawtucket, R. I. (Geo. A. Carpenter, C. E.)—It is not possible at this time to furnish information of value. All work will be done by "day labor."

Providence, R. I. (J. A. Latham, C. E.)—The people are talking about the advisability of building some sewers.

Quincy, Mass.—All work will be done by the day.

Saratoga Springs, N.Y. (J. S. Mott, C. E.)—Probably 2½ miles of water conduits will be constructed this season, but not yet decided upon.

Taunton, Mass. (Geo. A. King, C. E.)—Appropriation of $15,000 for block paving and macadamizing pending; $40,000 appropriated for additional pumping engine.

Bridges will be built at Cumberland, Md.; Elgin, Ill., two, at estimated cost of $50,000; Joliet, Ill., $15,000; Macon, Ga., $37,000; Medford, Mass., probably at cost of $10,000; Rockford, Ill., $3,500.

The reports show that no work is contemplated at the present time at Menomonie, Michigan; Stillwater, Minn.; Haverhill, Mass.; Sioux City, S. D.; Greenwich, Conn.; Jeffersonville, Ind.; Lafayette, Ind.; Ogdensburg, N. Y.; Ashtabula, O.; Logansport, Ind.; Hot Springs, Ark.; Columbia, Pa.; Bridgeton, N. J.

Much information is given in detail regarding work to be done during the season in the "Improvement and Contracting Department" of this number of MUNICIPAL ENGINEERING.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

TESTING CEMENT IN SEWER WORK.

Please let me know the best work on practically testing cement in sewer work

J. J. S., Grand Forks, S. D.

There is no book which will be entirely satisfactory. Byrne's "Inspector's Pocket Book" ($3) gives a few rules for rough comparisons of different lots of cement of the same brand, which will help the inspector to determine whether the various lots are nearly uniform with the tested and approved lot. The results of these tests are not supposed to be accurate and must be proved at intervals by more

elaborate and accurate tests. Spalding's "Hydraulic Cement" ($2) gives approved methods of inspecting and testing cement. The methods differ in detail with the kind of cement, the requirements as to strength and uniformity, the character of the work, the conditions of materials and weather, etc., so that general rules can not be laid down which will be applicable in full to particular cases. The engineer-in-chief in charge of the work must determine these matters for the individual conditions and instruct his inspectors in the requirements of the work and the methods of determining in detail how nearly they are fulfilled.

HOW TO LAY CEMENT FLOORS FOR SEVERE TESTS.

We are readers of your valuable monthly magazine, and want to know what effect hot water will have on cement work where the top coating is made of imported cements, like Alsen's, Schifferdecker and others. The work is for a cement floor in a distillery, and hot water will be running over the floor a good part of the time, especially in the gutters made of the cement.

W. A. Guenther & Sons,
Owensboro, Ky.

Cements like those mentioned will stand the "hot test," and should be able to withstand the chemical action of the hot liquids mentioned. Failure will come in the pavement, if at all, from the unequal expansion and contraction of the cement floor and gutters on account of the large and sudden differences in temperature. The floor should be laid in rather small blocks, of the same mixture throughout, and with joints, which will allow expansion, at more frequent intervals than is usual in cement walks. The joints can be filled with asphalt or similar material to make the floor as nearly impervious as possible. They will probably need occasional cleaning out and refilling. If the floor must be water-tight, it may be advisable to put in a sub-layer of water-tight material, cement or asphalt, with small channels or grooves to carry any water getting in to a drain along the lowest side.

DIFFERENCES BETWEEN "NATURAL" AND "ARTIFICIAL" ASPHALTS.

Will you kindly explain, through your valuable magazine, as to the difference between "natural" and "artificial" asphalt, which I do not clearly understand? I am under the impression that the "natural" product has been used and is recognized as a standard for street paving, and I would like to know if such is the case with the "artificial" material. How is the latter produced, and can it be without injury to the product? Is it admitted for use by eastern specifications, or has it been demonstrated that it can be used with safety in paving?

Chas. S. Derham, San Francisco, Cal.

The terms "artificial" and "natural" have been used in connection with asphalt in two or three senses. A firm in Pittsburg manufactures a product with many of the characteristics of asphalt which, it is claimed, is artificial, formed by chemical action. The material has been used to some extent in pavements, but its use is very restricted.

The second sense in which "natural" is used by some persons is to indicate that the asphalt is used in the natural form as taken from the ground, and is not put through any process of refining. The amount of refining required depends upon the original purity of the asphalt, the amount of extraneous matter gathered with the asphalt, and the purpose for which it is to be used. Asphalts of all grades of original purity are now in use, and no restriction is put upon the amount of purification, provided the resulting product is a good paving material.

A third application of the terms "natural" and "artificial" is to the paving mixtures. Most paving

mixtures used in this country are artificial in the sense that they are mixtures of natural or refined asphalt with sand, limestone dust, oil, etc., in proper proportions to produce a durable wearing surface. Most paving materials in Europe are natural in the sense that the mixture of asphalt and rock found in the mine is very nearly that required for pavements. These asphaltic rocks require treatment, however, and some changes in material to prepare them for pavements. The amount of such "rock asphalt" used in this country is increasing. A few successful pavements have been made with rock asphalts mined and treated in this country. Some pavement mixtures have been made by mixing two or more rock asphalts from different mines. Our advertising pages give the names of several firms supplying each class of asphalts and laying pavements with them.

SEWAGE DISPOSAL IN SMALL CITIES

This city will construct a system of sewers in the near future. The topography of the ground is such that it is difficult to have a main sewer with leads to it, and divers plans have been suggested for the disposition of the sewage. Please inform me of some of the cities having from ten to twenty thousand population, in this or contiguous states, where successful disposal plants are in operation?

David Y. Johnson, Mayor,
Bedford, Ind.

The state of Ohio has two or three sewage purification plants on the chemical precipitation plan, of which the successful plant at Canton is a type. Champaign, Ill., has Professor Talbot's septic tanks, which for the duty required of it is very successful. The city engineers of these cities can supply reports upon the operation of the plants. There are some other successful plants of smaller size. These two are good examples of successful plants for the conditions existing in these two cities. If too much is required of either system it will not give satisfaction. Local conditions definitely determine the nature of the plant and consequent cost of operation, and a plant which is successful under one set of conditions may be entirely unsatisfactory under another. This can be determined beforehand concerning any standard system of sewage purification, if expert advice is sought.

TAR CONCRETE MIXTURE FOR SIDEWALKS AND DRIVEWAYS.

Can you give me a good formula for a tar concrete mixture for sidewalks and driveways? Some of our driveways have not turned out satisfactorily. We use a large proportion of hard pitch in our mastic or wearing surface together with coal tar and fine screened gravel that has passed through a quarter-inch mesh screen. The pavement seems to granulate on the surface and crack after a year or two, and in a few cases, heavy teams have broken through it.

"Subscriber," Boston.

The modern processes of making gas and utilizing the by-products have changed the character of the coal tar remaining. Sometimes a relatively very small proportion of coal tar will materially reduce the durability of a pavement. The value of the coal tar depends upon the particular process of which it is the product. The use of hard pitch requires the use of too large quantities of oil, liquid asphalt or other softening agent and oil, especially, if in too large quantity, it will separate from the pavement, causing disintegration of the surface. Cracks are due in part to the same action, but more to the mixture being too hard to stand the contraction by the cold of winter. This shows more in driveways with little traffic than in streets where the cracks are ironed out by the action of wheels. The mixture for driveways must, therefore, not be so hard as that for streets, and, on the other

hand, the softening material must be such that the action of the elements will not wash it out or change its character. The exact mixture will depend upon the kind of asphalt selected. Some grades of asphalt and bituminous limestone are specially well adapted for sidewalks and driveways. Many of the firms supplying these materials have advertisements in our pages.

DISPOSAL OF STREET REFUSE.

Our city is considering the subject of installing a plant for the disposal of street refuse. The idea of a crematory seems to be the most feasible plan thought of. A report must be made at the May meeting of the city council, and the committee are anxious to hear from you. Any information you can furnish will be greatly appreciated, and at as early a date as convenient. Our city is about 25,000 population. I have furnished the committee with all the numbers of MUNICIPAL ENGINEERING I have.

Walter I. Brown,
Clerk, Water Board, Bangor, Me.

The disposal of the refuse collected by street cleaning is not usually attended with difficulty. There is seldom anything in such refuse liable to produce nuisance if used to fill low lots, and it is usually in demand for such purposes. Street sweepings consist largely of dirt brought on the street in the form of mud from other streets or roads, horse droppings, a little paper and a small amount of vegetable refuse. Most of the matter, other than dirt, has some value as fertilizer, and forms more acceptable filling than ashes or any other kind of refuse.

A number of articles on the disposal of garbage have appeared in this magazine. The description of Col. Kittelsen's plan for cleaning garbage and reducing it in amount will be found on pages 160 and 179 of the March number. A list of cities using processes for utilizing the by-products of processes for reducing garbage is given on page 172 of the same number. Boston and Cincinnati may be added to the list. See page 372, December, 1899, for statement of plan in the latter city. On page 99, August, 1899, will be found a short but clear statement of plans used in England. On page 31, January, 1899, is a sketch of a plan for separating garbage and refuse into classes for separate disposal. On page 386, June, 1899, will be found a list of the principal articles appearing in this magazine on this subject prior to that date. These articles together give a summary of present practice in garbage collection and disposal as complete as can be found anywhere.

DEFECTIVE VENTILATION OF COMBINED SEWERS.

In the September, 1899, number of MUNICIPAL ENGINEERING, Question Department, you appear to emphasize your statement that it is when the separate system of sewers is used that the house sewer need not be trapped. Does this mean that there is something about the combined system, no matter how well designed and built, nor how well plumbing is inspected and regulated, that makes these traps necessary?

Chas. Booth, Town Eng.,
Westmount, Canada.

The emphasis is really laid upon cleanliness of sewers in the answer referred to, which will be found on page 151 of the number for September, 1899. When stating that "there is good reason for (traps) where combined sewers are used," several facts were in mind. First, that many combined systems which have grown up with the city, were never designed properly, if they can be said to have had a design. There are many sections of such sewers which can not be kept clean, and which give opportunity for the formation of sewer gases. Bad construction, even with good plans, is responsible for additional opportunities of this sort. In newly-constructed systems of good design and construction there is much time when the flow of sewage through

the sewers is insufficient for cleansing them. This is due in most cases to the fact that the system is not yet fully developed and the amount of sewage flowing is not yet sufficient to make the sewer self-cleansing at all times. Time and the increase in population will remove this trouble. In a few cases the proportion of storm water to sewage is so great that special provision must be made to concentrate the dry weather flow in a small channel. If this is not done, and in acceptable designs it is sometimes not feasible, there is some opportunity for deposits.

If a combined system is well designed and constructed and in use to the full extent provided for in the plans to make it self-cleansing, or if it is carefully cleaned at frequent intervals, outside traps are not absolutely necessary if the soil pipe runs above the roof. The same statement applies to sewers on the separate system. The only difference is that the conditions described occur in full most frequently in the latter class of systems.

MEASUREMENT OF SEWER PIPE.

A. has just completed his contract for laying sewer pipe. Said contract and specifications call for a certain price per lineal foot for all pipe laid, so much for man-holes and flush tanks complete. The work has been accepted by the city. In settlement the city deducted the amount of pipe in man-holes and flush tanks. A. claims he is entitled to straight measurement for every foot of pipe laid. Is the city or A. correct?

P. Halloran, Paducah, Ky.

If the exact method of measurement is not defined in the contract, custom should govern. Probably the most common method of measurement is from center to center of man-holes and flush tanks. This custom has probably grown up because these are the distances shown on the plans upon which estimates were made and which are the basis of bids. If half pipe are used in forming the channels through man-holes there is chance for an additional claim that the width of man-hole should be counted as length of pipe. If the price bid for constructing the sewer is so much per foot including all appurtenances, the width of the man-holes and flush tanks will count as length of sewer. If the bid is per foot of sewer and man-holes and flush tanks are additional, the same contention may be successful. If the bid is per foot of pipe laid, the width of man-holes and flush tanks might properly be left out of the measurement The bid for laying pipe is likely to be made without reference to the trouble of making junction at man-hole, and the bid for man-hole is supposed to include all the work of making the man-hole. The usual contention of the contractor is that the trouble of making the junction is enough to warrant charging as though the pipe was laid through the man-hole. This is very nearly correct, and the claim is frequently allowed on this account, although a strict construction of the bid would rule out the extra charge.

USE OF LARGE FLUSH TANKS FOR CLEANING OUTLET SEWERS.

I contemplate installing a large flush tank, about twenty-five thousand gallon capacity, on our outfall sewer (18-inch pipe), to be supplied with flushing water by means of a 12-foot "Aermotor" wheel, to be placed on a steel tower about forty feet above the surface. We have almost constant winds in this region and plenty of water at a depth of twenty or twenty-five feet. Will you kindly give me any information you may have along these lines, and let me know what you think of the project from a financial standpoint and otherwise? Water comes high here for flushing purposes.

Geo. C. Wimberly, City Engineer, El Paso, Texas.

It is not customary to use large flush tanks to aid in keeping outlet

sewers clean. Mr. Rosewater and Mr. Furtes have made some experiments on the value of flush-tanks in small sewers, some of the results of which have been published. They show the value of flush-tanks in cleansing the ends of small pipe sewers where there is not a continuous flow of sewage. There are few results for pipes as large as 18 inches diameter. Adam's "Sewer Flushing Diagrams" ($5) is an English work having a few results for large pipes. The result for an 18-inch sewer on a gradient of 1 inch in 353, shows that the velocity is reduced to the theoretical velocity for sewer running half full within about 500 feet of the tank, and the sewer is running half full (9 inches deep), about 5.5 inches of this depth being due to the extra flow from the flush-tank. The depth of flow at the tank is but 12.5 inches, due, probably, to connection being inadequate to permit the water to enter rapidly enough to fill the sewer full. The quantity of water discharged was 766 gallons. This result is not very encouraging, especially when the diagram is followed out, and it is seen that, practically, all effect, except some increase in depth of flow, is lost within about 1,000 feet. More water and a quicker entry would have more effect and farther extended, but a study of this diagram and of others for sewers, larger and smaller, does not lead one to think that the result will be commensurate with the cost of installing the tanks and keeping them supplied with water.

If the sewer system is not in general use so that the computed flow through the outlet is not yet reached, or if the outlet is on a gradient so low that it could not keep itself clean if running at maximum velocity, it is evident that the sewer must be cleaned in some way. The most common methods are by using the sewage itself as a cleansing stream, by means of dams in man-holes which can be quickly removed when the sewage has been allowed to gather head enough to give a good velocity. Man-holes should be not more than 300 feet apart, and it may still be necessary to resort to tools at times. The "pill" is used for smaller sewers, and if well constructed and used often enough to prevent solidification of deposits, can be used in an 18 inch sewer. It would seem possible to design a disk slightly smaller than the pipe with a frame which can be used the same as a "pill," but can be turned to a horizontal position, or caused to collapse by means of an auxiliary cord, so that it can be drawn back when an obstruction too great to pass and too solid to wash out is reached.

ASPHALT FOR RESERVOIR LINING.

I desire samples of various brands of asphalt suitable for lining a small reservoir. We desire to give one of our reservoirs (distributing) a coat or two of asphalt over the cement concrete now in place, which is cracked. There is considerable loss from leakage. I want samples for testing to see if the water at this place will have any solvent action. I understand that some waters render asphalt porous. Is this true? Or is there anything better than asphalt to reline the reservoir?

D. S. Merritt, Engr. and Supt.,
Tarrytown, N. Y.

The dealers in asphalt who advertise in our pages will be quite willing to supply samples of asphalt for purposes of the test desired. It is probable that the chemical effect of water is not so much upon the asphalt as upon oil or impurities contained in the mixture, though under some conditions a slight deterioration of the purest asphalt obtainable is observable after long immersion in water.

The use of asphalt for reservoir linings has increased somewhat during the last ten years. In the few cases where partial failures have been recorded the fault has been with the settlement of the foundation or wall, or in the earlier cases in the lack of experience as to the best manner of applying the asphalt. The various asphalts have been used. The usual specification calls for an asphalt at least 90 per cent. pure. A paper by L. J. LeConte, before the American Water-Works Association in 1896, gives the early history of this use of asphalt and the methods which have been developed for suiting the mixtures and methods of application to the local conditions. Asphalt seems to be the most satisfactory material for an impervious lining to a reservoir which has yet been tried.

BOOKS ON STREET RAILROAD LOCATION AND CONSTRUCTION.

I would like to get a book that gives in detail the work of the civil engineer in street or electric railway location and construction. How is Crosby's "Electric Railway in Theory and Practice," or Brooks' "Street Railroad Location"?

C. N. Schwab, Napoleon, O.

Brooks' "Handbook of Street Railroad Location" gives instruction on the details of the work of location and construction, including the ordinary problems in location of railroad curves, adapted to street railroad conditions, turnouts and sidings, the problems of location, earthwork computation, estimates of cost, inspection, etc. The necessary trigonometric and railroad tables and formulæ are also given. Crosby's book takes up the problems of the electric railway as well. It is now out of print. This office can supply Brooks' volume.

[By C. W. Tooke, Professor of Public Law, University of Illinois, for MUNICIPAL ENGINEERING.]

THE ILLINOIS LAW FOR CONSTRUCTION OF WATER-WORKS.

I have prepared plans for several water systems to be built under the new water-works law of Illinois for villages, allowing them to construct plants to be paid for by certificates of indebtedness issued against the plant itself. Will you kindly give me your opinion of this law? It seems in this city the brokers ask too much discount for these certificates, and for this reason I would like to ascertain if in your opinion this is a good law for villages and would you advise that they take advantage of it in building water-works?

R. C. Huston, C. E., Chicago, Ill.

The statute to which reference is made was passed by the general assembly in 1899. In brief, its purpose was to provide a means whereby a municipal corporation would be enabled to construct a water plant and not have the cost thereof a charge against the general funds of the municipality. It provides that any city, incorporated town or village, may acquire or extend a water-works system, and, in payment of the building, purchase or enlargement thereof, may issue certificates of indebtedness limited in their payment solely to the water fund hereinafter provided for, such certificates to bear interest at a rate at not less than 6 per cent. per annum, and to be payable semi-annually, and in no case shall they be issued at less than par value.

To the water-works fund in question is to belong the entire proceeds arising from the operation of the water-works system, and this fund is to remain inviolate until the certificates issued against it and the interest thereon are fully paid, and no warrants against the fund are to be paid by the treasurer of the municipality unless the same be drawn in payment of the necessary operating expenses or in payment of the certificates of indebtedness or of the interest thereon. As a further security to the holders of the certificates of indebted-

ness, the municipality may convey by way of mortgage or deed of trust the water-works system so acquired or enlarged, which mortgage or deed of trust is to contain the same reasonable stipulations as in case of the transfer of real property by these means in ordinary transactions. If there is a default in the payment of the said certificates continuing for the space of ninety days, the mortgagee or trustee has the right to declare the whole of the principal and interest on such certificates at once due and payable and proceed to foreclose the same in any court of competent jurisdiction.

It can thus be seen that a municipality that avails itself of the provisions of this statute is placed in a position similar to that of a private company which enters upon a like transaction. The person who takes the certificates must depend upon the fund against which they are issued for his payment and can not take the general credit of the city as additional security. In no case can he have a greater security than the value of the plant and its revenue, and therefore the purchaser of the certificates must investigate the security of his investment as carefully as any mortgage bondholder would do. The purchaser of the bonds of a city issued for the construction of water-works, on the other hand, is usually satisfied with a knowledge of the credit of the city and the general reputation of its financial condition. In both cases it is apparent that the legality of the issue must be taken into consideration by the broker. Thus it can be seen that there is no reason why a city should expect a better credit for its certificates issued under this law than a private company would obtain under similar circumstances. Of course, on the economic side, the present time is not favorable for the erection of water plants under this law because of the greatly increased cost of the materials of construction requiring an amount of money dangerously near the limit of safe investment. But where the city is making an extension or enlargement of the old plant which is already paid for the certificates should be regarded as a good investment and should command a favorable market. So, too, in the purchase of an old plant upon a careful estimate of the present worth of the plant and its earning capacity such an investment would be reasonably conservative.

Either for the purpose of purchase or extension under the limitations stated, we would regard this method of raising money a convenient alternative for a municipality which has a good credit but which may be adverse to the issuing of bonds. The law was doubtless framed to help those cities which had approached dangerously near their constitutional limit of indebtedness, so that their bonds would be looked upon with suspicion if not with discredit. For such cities the law is regarded by some as an outlet from the strict limit of the constitution, but in the opinion of the writer it is extremely doubtful whether the courts will take the view that a debt contracted under this law is thus removed from the constitutional limitation, and that the certificates thereof will be considered valid. It is in this fact that the law has not been interpreted that the weakness of the certificates of a city with a debt approximating the constitutional limit now lies, and no conservative business man would care to invest in such securities without taking such a risk into consideration.

In this connection, it may be noted that the law under consideration is only one of many similar measures that are being tried by several of the states in order to overcome the serious evils of the rigid restrictions of the percentage limitations upon municipal indebtedness as contained in many of our state constitutions. The limitation in Illinois, for example, is five per cent. of the assessed valuation of the real and personal property, as determined by the last annual assessment for state purposes. By operation of the general property tax, under which there have been gross undervaluations of realty and the escape of much of the personalty from taxation, the limit has been pressed down to less than one per cent.; and the new revenue law makes one-fifth of the true valuation the assessed valuation for all purposes of debt limitation. So that if every dollar of property in a city were properly listed for taxation, at the utmost the city can not incur an indebtedness greater than one per cent. of its true property valuation. When we consider that under the new law a great deal of property will escape, and that the same inducement still exists for under-assessment between the counties of the state and in turn between the towns of the county, the limitation becomes in operation far less than one per cent.

Thus the condition is brought about that our cities are practically precluded from the construction of their own water and lighting plants, and sometimes from the construction of sewer systems. If a small city has constructed its own water plant and has issued bonds payable at an outside limit of twenty years, the chances are against the power of the city to build its own lighting plant in the same way. No distinction is made in our laws between debts incurred for the construction of productive plants and those for other purposes, nor is the value of the plant in question taken into consideration as an available asset. It has been urged by some authorities that all bonds issued for water and light or for any productive enterprise by a municipality should be excluded from the constitutional limitation by express amendment, and this was the recommendation of the committee of the National Municipal League appointed to draft a model municipal corporations act. The report of the committee was accepted by the League without the adoption of a provision suggested by the writer of this article to the effect that in that event such indebtedness should not be considered as a lien on the general revenues of the municipality, but should only be secured by a lien upon the property and the revenues of the plant in question. This is the provision that the Illinois law attempts to put in operation, and the interpretation of the courts may be such that the law will have that effect. But the best way to accomplish the end in view would be to so amend the constitution of the state that all bonds or certificates of indebtedness issued by a municipality for such a productive purpose should be relieved from the operation of the limitation of indebtedness and at the same time provide that such bonds or certificates should be secured only by the property and revenue of the plant for the construction of which they are issued.

Some objections may be brought against this solution of the problem, as the one that the securities would not carry with them the credit of general municipal bonds. But in answer to that objection, we

may point to the fact that it would open the door to municipal ownership, which is now closed to many of our cities, and, further, that as soon as the method was thoroughly understood these securities would stand upon a far better basis than those of a private company, because of the advantage of an unlimited franchise that the city would enjoy. With the establishment of state municipal boards to advise municipal corporations upon the methods and means of taking advantage of such an act, we might look for a development of municipal enterprise in this direction as conservative as one could wish, and yet as successful as that attained under the English system of central administrative control. The writer believes that under these restrictions not only could no objection be raised to municipal ownership, but that if municipal ownership can not be made to succeed under the same conditions as private ownership it does not deserve to succeed in this country. The whole question would be removed from the field of partisanship to that of practical experiment, and solved in each individual case upon its merits without the danger of involving the municipality in heavy indebtedness to be paid by succeeding generations.

LEGAL DECISIONS AFFECTING MUNICIPAL AFFAIRS.

[By C. W. Tooke, A. M., LL. B., for MUNICIPAL ENGINEERING.]

SPECIAL ASSESSMENTS BY THE FRONT FOOT.

In the United States circuit court for the district of Washington Judge Hanford passed down a decision at the February term sustaining the view of the Norwood-Baker case adopted by other federal judges. (Cowley *v.* City of Spokane, 99 Fed. Rep. 840.) Under the stipulated facts of the case the city officials, in making the assessments for the improvements in question, gave no consideration to the benefits to accrue or the injury which might result to the abutting property by reason of said improvements, and did not apportion the costs or assess the abutting property with reference to any special benefit to the said property, but made the assessment upon an *ad valorem* basis, or in other cases upon the front foot plan. The court decides directly that such assessments for public improvements under the statutes of Washington, which require that the entire cost of the improvement be laid on the abutting property, and which are laid by the front foot plan or by other methods that do not take into consideration the benefits accruing to the property and the injuries resulting therefrom, are in violation of the constitution of the United States, which forbids the taking of private property for public use without just compensation.

RIGHT OF GAS COMPANY TO CONTROL ITS METERS.

In the case of the Consolidated Gas Company of Baltimore *v.* Blondell (56 L. R. A. 187), the supreme court of Maryland affirmed a decree granting an injunction to restrain its customers from placing governors to control the consumption upon the meters furnished by the company, and to require the removal of those already placed thereon. The court bases its decision upon the fact that the meters

are the property of the company, over which it may exercise all control consistent with the rights of the consumers to reasonable service. The court holds that the placing of such a governor upon the meter or lead pipe connections, without the consent of the company, is an unlawful trespass; that the company, being liable for the safe condition of its apparatus, must be considered to have a corresponding right to control it, and that the injunction will be granted irrespective of the question of injury to the meter. The court further lays down the opinion that if the consumer is to be allowed to use such a governor on the piping that belongs to him as his personal property, even then he must submit to such reasonable regulations as to the manner in which it is done as the company may see fit to provide. The decision is based upon the soundest reasoning, and comes at a time when unlawful interference with the property of public service industries by private consumers and municipal corporations has become altogether too frequent.

SEWER CONNECTIONS—RIGHTS OF INDIVIDUALS TO MAKE CONNECTIONS.

Another case resolved in favor of the rights of the individual as against the control of the municipal corporation is that of Slaughter *v.* O'Berry, decided by the supreme court of North Carolina at its March term (35 S. E. R. 241). The action came by petition for mandamus by Slaughter against O'Berry, chairman of the sewer committee of the city of Goldsboro, to compel the granting of a permit to make connections with the sewer. Among the specified requirements of the city ordinance are the following:

"That no connection shall be made, but by some person elected and licensed by the city to make such connection; that said work shall then be done under the supervision and direction of the city inspector, and that the city shall furnish the materials and do the work of making such connection to within three feet of the building to be so connected with said sewerage; that the application for such connection shall be in writing, setting forth the location of the building to be connected, and the purposes for which the sewerage is to be used, and a survey and plan of said sewerage, containing an estimate of the cost of said connection; and that the applicant shall deposit a sufficient amount of money with the city to defray the expenses of such connection."

The court in granting the petition admits that the city, as the owner of the sewerage system, has the right to protect the same from improper uses and connections, but holds that it should be done in a reasonable manner. The plaintiff having been licensed to make the connection, and having complied with all the requirements except that of making the deposit specified and asking the privilege of furnishing his own material and of doing his own work in making the connection, the court held that the ordinance requiring a deposit for this purpose to pay for the work is invalid, as interfering with the private property rights of the citizen. The regulation in question was not required for the public good and was therefore an unnecessary invasion of the personal and property rights of the plaintiff, and must be adjudged void. "Where it becomes necessary," says the court, "to invade private property, it must be done with the consent of the owner, or under the doctrine of eminent domain, when the owner would be entitled to compensation.

COMMENT ON CURRENT TOPICS.

Is Stream Pollution Permissible? A recent New Jersey decision upon the responsibility for stream pollution is of exceeding interest to all cities having sewers discharging into streams on the one hand and to all cities taking water supplies from streams liable to be polluted on the other. If this decision is found to be technically correct, it may become as much the fashion as the decision of the Missouri court, which, followed in Indiana, has resulted in declaring the Barrett law unconstitutional, and, in other states has nullified statutes assessing benefits for street improvements in proportion to frontage. A similar case in Connecticut asking damages for and restriction of stream pollution resulted in quite a different decision. The New Jersey decision is also contrary to cases in Massachusetts, Ohio, Indiana and other states. In short, it places the control of the pollution of streams entirely in the hands of the legislature, and, if the construction of a sewer system in a city to discharge into a stream has been authorized by that body, those affected by such pollution have no remedy by which they can abate the nuisance. Their only method of diminishing the danger of illness is to move out, and the only salve to be obtained is damages awarded at the end of a long and uncertain journey through the courts. This decision departs so far from those of the past and differs so much from the usual dictates of common sense that it hardly seems possible that other courts, even in New Jersey, will be able to deliver similar judgments. Luckily for much of the state of New Jersey, the legislature has just passed a law putting the matter of the protection of the purity of streams in the hands of a commission with full powers, so far as the legislature has them to grant, but, unluckily, its hands are tied by the lack of an appropriation.

Such decisions as this one in other states would set free many of the smaller cities and towns to whom the cost of sewage disposal has been a block in the way of progress toward a sewer system. It would at the same time set a larger number of water-works managers to looking for new supplies in the event of the construction of polluting sewer systems. Proper representations of the amount of damage may require the offending city to pay the expense of developing such new supply, but careful manipulation would be required in order to secure full value. What award of damages would be sufficient in case no other supply of water can be found it is difficult to imagine. A few such absurdities as this need but to be stated to show that the decision is not likely to be copied elsewhere.

Causes of Water Waste. The attempt to force the city of New York into a contract with a private company to secure an increase in its water supply led to an investigation of the adequacy of the present supply, the results of which present

some of the facts in the case in such shape that they must appeal to the taxpayer. With changes in names and figures used to represent cost and consumption the results can be applied to any city in doubt as to the best method of insuring an adequate supply. A review of the valuable report of John R. Freeman, a civil engineer retained to make a study of the matter, and a presentation of his recommendations, will therefore be of interest to many of our readers.

His estimate that the supply from the Croton water-shed will be sufficient for about five years more agrees with that of the promoters of the new scheme, but shortens the time estimated by the designers of the present system a few years. Undoubtedly the shortage will begin in a very few years, and the time it will first be felt is hastened by the increased waste of the last few years. Before the new aqueduct was completed the shortage was excessive for a number of years, as many as fifteen or twenty. This old condition may not again be reached for another fifteen or twenty years. It is the duty of the engineer to fix the time of beginning of the shortage and to make as good a case as possible for his estimate. Municipalities move slowly and the first impetus must be given before danger actually exists, for after the works are begun they can not be completed for a period of years. Our city councils are always disposed to discount the statements of engineers called in to give advice on such questions as this, but much loss of money and of many things of greater value not readily reduced to the measure of cash, will be obviated by promptly beginning the work proposed. The delays incident to securing the best plans and the money to carry them out will postpone the time of completion of the new works long enough without unnecessary delays in taking the preliminary steps. Engineers have been known to overestimate the needs of a community, but seldon to overestimate the sufficiency of an existing plant.

Mr. Freeman shows that the consumption of water averages 116 gallons per capita per day. He estimates from a study of the consumption from hour to hour that 80 gallons of this amount is unnecessary waste, of which not more than 10 gallons is incurable waste. These figures are, perhaps, a fair average of American conditions. In some cities the waste is much larger, the consumption running in a few instances above 200 gallons. The city of London, with a consumption of less than 60 gallons, is proposing to take steps to reduce the enormous and, from their point of view, criminal waste of water. Mr. Freeman finds 24 gallons of metered water per inhabitant used for shipping, manufacturing, office buildings, etc., leaving about 12 gallons per inhabitant per day for legitimate uses. The causes of waste are poor plumbing, prevention of freezing in winter and procuring cooler water in summer by means of open

cocks, leaks in abandoned service pipes, in joints of mains and in old rusty pipes, in addition to wanton waste by connections, left open without reason. Loss through all these but the leaks in mains and pipes under the streets can be reduced almost to zero by a meter system. The engineer proposes that such a system be installed by the city, who shall own and keep in repair all meters and service pipes between main and meter. He recommends a careful and thorough inspection to locate all important leaks in mains.

A few of the smaller cities have inaugurated meter systems and usually with great success. The city of Bloomington, Ill., has postponed for a number of years the necessity of searching for a new supply by requiring meters, which are paid for by the property owner. The charges for water are so low that the consumer is able to use all the water he needs at a cost to him less than under the old flat rate system, while the restriction of waste has so reduced the amount to be pumped that the city is deriving a greater profit under the meter system than under the old system. The cost of meters was made up in the first two years. In at least one case a property owner is now paying less for metered water drawn through five faucets, including bath and closet, than through one under the flat rate. No city which gives meters a thorough test removes them and no reasonable property owner objects to the meter when he understands its working. Only those whose idea of liberty is expressed by the word license make any objection and such persons deserve restraint in this as they have it in other directions. The cost of water is not, however, a controlling factor in many cases. Thus in New York the cost to consumers is as low as $1 per inhabitant per year. When water must be pumped the cost of pumping increases as the waste increases. The question of possibility of new supply controls in some cases, and in others the large initial expense necessary to install such new supply on account of the difficulty of securing it. The adoption of meters will give the city time to carry out the inspection for leaks in mains and so reduce the consumption that it will be possible to find time to locate a new supply and construct works to deliver it to the city before the threatened famine begins.

The report goes on to suggest sources for new supplies, including territory on the west side of the Hudson east and south of the Catskills, the Hudson itself at Poughkeepsie, Long Island, the Housatonic and others for high pressure fire protection in business districts, and a number of others. It is the most valuable contribution to this subject that has yet appeared.

Causes of Asphalt Pavement Failures.

The recent discussion in an article by Mr. A. W. Dow, the inspector of asphalts and cements, Washington, D. C., which appeared in the official report of the Engineer Department

of the District of Columbia, and was reproduced in the January number of MUNICIPAL ENGINEERING, should be of much practical benefit to municipal officials who are troubled by defects in their asphalt pavements. He discussed the principal methods of failure of asphalt wearing surfaces, and gave opinions regarding the causes of these failures and the reasoning upon which these opinions are based. Most of the ideas advanced are in accord with those of experts in asphalt paving generally, but this is the first time they have been put in accessible shape, well arranged, well stated, and all together.

The cause of long irregular cracks, usually running across the pavement, is shown to be a failure to produce a mixture suited to the temperature and traffic conditions. Suggestions are given for the kind of sand and the proportions of the various materials for streets under several conditions, that cracking may be reduced to a minimum. Among these are a north and south street of little traffic in a climate with great ranges in temperature, probably the conditions hardest to meet; a shaded east and west street, with medium traffic, probably the easiest street to lay; heavy traffic under combinations of the other conditions. The reasons for the failure of expansion joints to correct the difficulty in a material with so little structural strength as asphalt are well stated.

Disintegration from rolling or crowding is shown to occur from having too soft a wearing surface or a defective bond between the layers of the pavement on account of the smooth concrete, dirty surfaces or other obstacles to a close union of the surfaces. Very heavy traffic will develop more or less of the defect, but it is inexcusable with moderately heavy traffic. A definite formula for the kind of sand to be used, and general statement of the quantity of asphalt cement as determined by the climate is given for such a pavement that the best results may be obtained. Defective base or binder is the most frequent cause of rolling or crowding.

Pavements disintegrate in spots because so hard that in cold weather the traffic will break the surface and wear it away; because the wearing surface absorbs oil from the binder, especially if coal tar is used in it; because of leaks of illuminating gas; because water gets in through the foundation. For the smaller cities, where small or portable plants are used to prepare the mixtures, Mr. Dow might add the inequalities in heating and possible burning of materials from careless handling.

Such papers as this are of much practical value and greatly relieve the monotony of ordinary official reports.

Effect of Rails on Pavements. The interest of our correspondents in street railway construction suggests a reference to a paper before the American Society of Civil Engineers, in 1897,

by Edward P. North, and especially of the discussion of the same. Sixty-three pages of discussion by twenty participants give evidence of the interest of municipal engineers in the subject. Almost every one presents some special form of rail or of construction as the best solution of the problem for the conditions he states, but all emphasize the necessity for a solid foundation and for a girder rail deep enough to be permanently rigid under the traffic. A foundation of concrete under the ties, brought up to the base of the pavement, is a favorite requirement and insures a permanent roadbed if on well-prepared sub-grade. Nearly all condemn the T-rail, the only exception of note being City Engineer Cappeten of Minneapolis, where a special form of construction for asphalt pavements was used with a row of granite blocks set on the inside of the rail 1.5 inches from the rail, this space being filled at the bottom with cement grout and at the surface with asphaltic cement. The rails and granite blocks being set in concrete and on concrete instead of wooden ties, the construction is solid and durable. It is also very expensive.

The favorite depths of rail seem to be six inches for asphalt pavements and eight inches for stone pavements. A few exceptionally good constructions are made with seven- and nine-inch rails respectively. The side-bearing rail has a few more votes than any other. It seems to be the best average rail, meeting more of the conditions imposed than any other single form. The flange should not be too wide, unless special means are used to fill the space between the web of the rail and the granite blocks edging the track. If there is any tendency for traffic to follow the tracks, however, it should be wide enough to insure that all ordinary wagon treads will be accommodated. The principal objections are the fact that a groove is formed into which wheels drop and from which there is a little difficulty in turning. With a solid roadbed and proper setting of stone border inside the rail, this trouble can be reduced by beveling off the corners of the blocks. Asphalt can be built up slightly, also, enough to turn all water falling between the rails onto the rail. In some cases where asphalt is laid up to the rail, it is kept as low as the flange.

On streets nearly level, special sewer inlets must be inserted to remove the water gathering between the rails at the bottom of the grades. Grooved rails make construction of pavement along rails easier and keep wagon wheels from dropping into the groove. If there is any reason for a tendency of traffic to follow the rails, as in crowded streets, the pavements will wear most rapidly next the rail, and when a break is once started it will rapidly form into a rut. The form of cross section must therefore be selected in accordance with the requirements of the local conditions. The question of granite or brick row or toothing next the rail in as-

phalt pavements seems to reduce to a question of foundation. If the foundation is good (for which concrete under ties is practicably indispensable) asphalt may be run up to the rail on the outside, and frequently is so laid on the inside, though a row of smooth blocks laid about as described in Minneapolis seems to be preferable. If the foundation is not as good there will always be trouble along the rails and breaks will be more easily repaired if the toothing or row of blocks is used.

With the provision of good filling underneath the block and next the rail, Buckland's iron paving block should aid in increasing the durability of brick or stone pavements next the rails. It performs the office of both groove in rail and special form of block, and with less cost. It is not equal to a grooved rail in durability, especially if it is not most carefully and solidly set, but it should serve as an edging better than either brick or stone.

GAS vs. ELECTRICITY FOR LIGHTING PURPOSES.*

By J. R. Cullinane.

I have had no experience in selling either gas or electricity in competition; on the contrary, nearly my whole experience has been in selling both articles at the same time to the same class of patrons. I will endeavor to tell you something about selling gas and electricity from this standpoint.

It is a hard matter to adjust the prices of both articles on an equal basis, and especially is this so in a small city where there is a demand for flat rates. Flat rates are a nuisance, where the company using them is also selling gas and electricity through a meter service. I will add that flat rates are very unsatisfactory. In early days I asked a promoter of electrical plants (who in those days usually represented some large manufacturer) why he asserted a sixteen candle power incandescent lamp should be sold at a certain flat rate. He replied that this certain price was all we could get for it; that we must meet the prices at which we were then selling gas, and added that the demand for electricity had to be met, irrespective of its cost. Indeed, he was uncertain as to its cost. Of course we all know more now as to its cost than we did then, but I have often observed that a great many of the plants in Texas established their prices in the same way, and probably for the same reason. The fair and equitable way to sell electricity is through meters. In the gas business the meter is used exclusively. The manager of a gas company can tell you his leakage and his yield, and exactly what it costs him per 1,000 cubic feet to make or deliver his gas; hence he can deliver his product on a basis through meters so that every foot of gas sold brings in its pro rata profit.

In the electrical business we should do the same thing. We should know our leakage and what it costs to generate and deliver the current per 1,000 watts. To do this we should measure the current as we send it out through large station meters, and then sell it exclusively through meters to our customers. All flat rates should be avoided. The investment in meters will be large, but I think the ability of the plants to sell to a large number of customers, and thus save additional machinery, will fully repay for the investment in meters. The early prices of electricity were established to compete with the then existing prices of gas. Gas at $2 per 1,000 cubic feet was figured out equal to current at 20 cents per 1,000 watts, or 1 cent per ampere hour, and the flat rates were adjusted accordingly.

Assuming the prices of gas and electricity adjusted on an equitable basis, we will pass to the next problem, that of handling the "Dear Public." If we find any of our patrons with ideas as to the kind of light they

*From a paper read at the Waco meeting of the Southwestern Gas, Electric and Street Railway Association.

desire to use, we encourage them in their choice. We always endeavor to let them say what kind of light they shall use without any influencing from ourselves.

Necessarily, the dual interests of a company selling gas and electricity for lighting purposes clash; but we find many places in our line of customers where only gas will serve the purpose and other places where only electricity will answer. We always take advantage of these opportunities to keep the interests from encroaching on each other, and at the same time increase the growth of each business.

In the lighting business exclusively, each kind of light has its particularly good points. In the management of a company selling gas and electricity we find other territories besides the lighting business in which to sell our products; and in these we find the dual interests do not clash.

Our sales of gas for cooking purposes in no way affects or decreases our sales of electricity. To a dual company this is a wide field—40 per cent. of our gas is sold to this class of business, and the percentage is always growing. I can remember only a few years back when gas companies had only a small part of their output going through gas stoves. We have another large field for the sale of gas through the medium of the instantaneous water heater. This apparatus has reached a very high state of mechanical perfection, and the demand for it is growing. They are very satisfactory to the patrons of a gas company, and are also very satisfactory to the gas companies themselves.

By pushing the sale of gas in these two fields, we do nothing to harm our electrical business. The advent of the Welsbach burner brought joy to the gas man, but the Welsbach burner is in direct competition with electricity, and it is not my purpose here to discuss that side of the question.

As stated above I will endeavor to show you that there are spots in the dual business that are not necessarily competitive.

I have stated a few of the fields in the gas business that can be pushed without harming the electrical business. On the other hand, in the field of electricity, we have a class of business that can be pushed that will not interfere with sales of gas. I have reference to the sale of current for use in small motors and fans. This is a very wide field and a very profitable one. The prices usually paid for power current are more renumerative than those paid for lighting purposes.

Nearly any electrical company can operate a power circuit successfully and profitably. The number of places that will use motors and fans is astonishing. To a company doing a dual business this class of trade is of large assistance. Another field for selling current is in the way of advertising. You will find many customers willing to spend money for electricity in different ways in advertising their business. Some will use arc lights or incandescent lights or both for illuminating the outside of their stores and show windows and others working electrical devices and signs to attract attention to their stores. This is not in competition with the sale of gas, and brings in quite a nice return.

Further, by combining the businesses, if you can control the territory and avoid the awful prices usual where competitive plants exist, there is a hope for success. I am frank to say I often wonder how some of the competitive plants exist and sell their products at their prices. I think good management should mean good prices, but I don't understand how some of these competing plants can pay actual operating expenses, to say nothing of fixed charges, interest, depreciation and repairs. I assume they know their business and are pleased with the results. Any way, one set of people are happy where there is competition in the lighting business, and that set are my friends, the "Dear Public."

HOW TO GET ON IN ENGINEERING WORK.

In an address at the last annual meeting of the Indiana Engineering Society, Mr. A. W. Smith, former city engineer of Kokomo, in offering some advice to young engineers, said:

"It is not the thing to wait for five, ten or fifteen years and then avail yourself of some chance opportunity to get a little of the practical workings of engineering; young engineers are apt to think. 'Oh, yes; I've been through all that; I know just how it is done; I'll only have to rub up on one or two things a little.' The chances are that you will get more rubbing in a short time than you dreamed of. You will find that in the years of waiting you have missed many steps in the march of progress; and in your hurry to catch up with the procession you will stumble many times, and some one else with far less theoretical knowledge may pass you on the road. If you cannot get a position at home as civil engineer go to the railroads, go west or northwest, take a position anywhere as assistant, rodman—anything, so you get to work while you are young; that is, if you mean to amount to anything in your profession. The great trouble is, that so many expect to step out of college into a lucrative position. This is not easy to do; hence, the long years of waiting. I am not sure that these positions are best for these new men;

the chances are there will be so many mistakes made in large and important work, that you are apt to get discouraged, and I know your employer is sure to. I honestly think it is better to begin at the bottom. I think we will all agree that practical experience comes in very handy when we follow in the wake of, say, half a dozen or more engineers. Many of the early surveys were carelessly made, many records incomplete; and after being corrected and modified by their followers, make a piece of crazy patchwork indeed. The heights and depths and angles of grades and lines are quite bewildering at times; much of this, the result of inexperience. Experience in running the records is another help that only time will give us; to know just where to find needed information, or whether it is a matter of record at all, is a saving of time and money. Daily we are confronted with problems or situations that no college education will prepare us to meet; our wits must be sharpened, our conclusions formed by years of practice; conditions arise which must be met at once; there is not always time to experiment or figure them out; especially municipal engineers know how fully their time is taken up when the busy season is on; how much they are needed in a half dozen places at once, how much information they are expected to give; not that our councils expect ever to use any of it; oh no, they just want to see if we are informed. They have ideas of their own as to how things should be done, and we thank our stars if they don't proceed to have them carried out in their own way. Not the least important thing that we have to consider is these men, some of them well-informed, but not in our special line; still, keenly alive to the city's interest, while others are rather weak in their minds, but strong in their determination to run things. None of you here but have come in contact with these difficulties, and most of you at times have wondered whether it was best to throw up the whole business, or stay and fight it out inch by inch, because you knew you were right, and right does sometimes prevail. We make a good many blunders before we acquire the tact necessary to get along successfully; we have to meet men on their own ground, and as near as we can adapt ourselves to circumstances, without losing our integrity or belittling our profession. One can well afford to yield unimportant points pleasantly, thereby enhancing one's chances of holding on to more important ones.

"An engineer should by all means be a good business man; he is looked to for information about cost and values of material and labor; if he is posted about these things as he should be, and uses his knowledge in a business-like manner, he will be counted a valuable man in his position. It is surprising how many engineers when asked about the cost of constructing a piece of work, will say, 'I will look that up and find out;' or else frankly say that they do not know, and they sometimes do not even know where to look for information. Why don't they know? Why have they not been informing themselves? It is a part of their business. We should be informing ourselves all the time; there is no excuse for any of us not keeping posted in all the different lines of our work, with the vast amount of valuable information published in books, magazines and special papers that are to be had for the buying. Our profession is largely an intellectual one; students we must be all our lives; our course is not finished when we are through with college."

WATER WASTE IN NEW YORK.

Mr. John R. Freeman, M. Am. Soc. C. E., has submitted to Comptroller Coler of New York a valuable report on the water supply of New York. It shows that the present supply should, under proper regulations, be adequate for four or five years, that there is at present enormous unnecessary waste and that there should be inaugurated at once a thorough system of waste prevention, beginning with a meter on every domestic service. A feature of the report of general interest is the exhibit in Fig. 1, showing the consumption and waste of water from 1884 to the present time, embracing also estimates for the next five years. The average daily consumption in 1899 was 116 gallons, about half of which is waste.

In his study of waste, Mr. Freeman made hook gage readings at six minute intervals in the Central Park reservoirs, when all the water for Manhattan was coming through the new aqueduct which was carefully held at a constant depth. This was at a time of mild weather covering a period of ten days, when no ice formed, so there was no waste on account of allowing faucets to run to prevent freezing. Mr. Freeman's conclusions from these gagings are given as follows:

Day after day the observations repeat with remarkable uniformity, reaching their maximum at 10 o'clock in the forenoon, dropping off a little from 11 to 1 p. m., rising again slightly at 2:20 p. m., falling off rapidly after 5 to 6 p. m., decreasing further after 10 p. m., until the minimum was reached about 3 or 4 o'clock in the morning, the draft until that time being kept up by the refilling of the house tanks, etc.

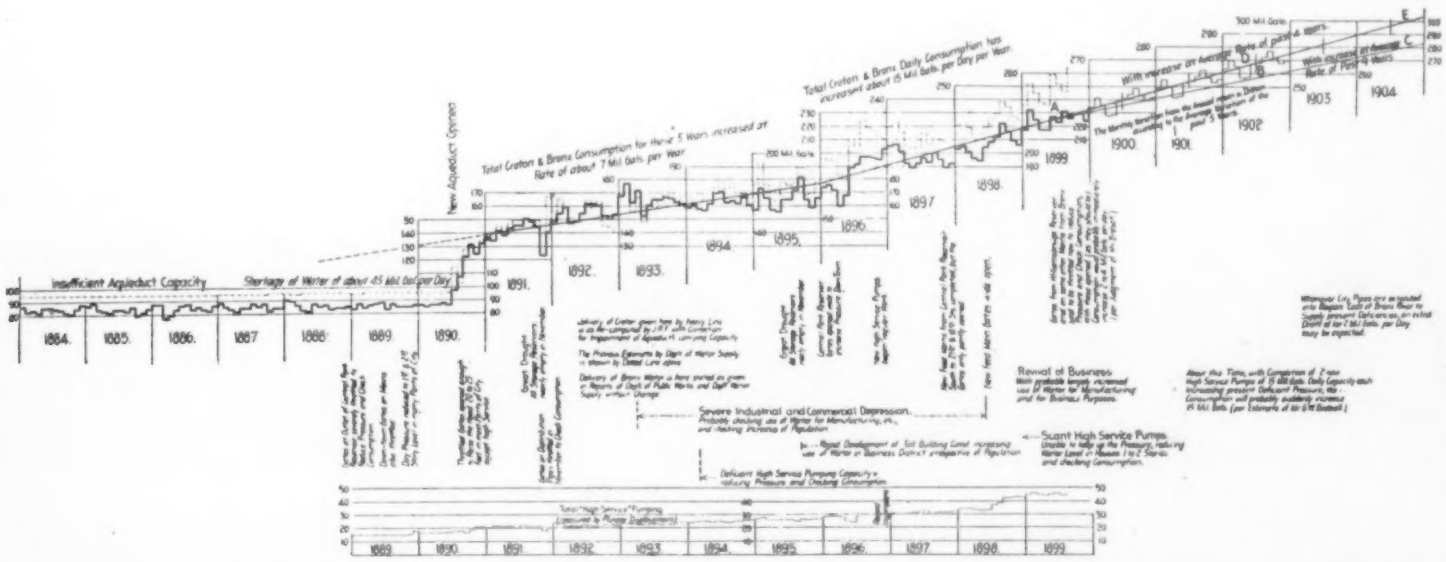

Insufficient Aqueduct Capacity
Shortage of Water of about 45 Mil. Gal. per Day
New Aqueduct Opened
Total Croton & Bronx Consumption for these 5 Years increased at Rate of about 7 Mil. Gals. per Year
Total Croton & Bronx Daily Consumption has increased about 15 Mil. Gals. per Day per Year
With increase on Average Rate of past 4 Years
With increase on Average Rate of Past 5 Years
The Warning from the Annual Waste in Excess according to the Average Increase of the past 5 Years
Severe Industrial and Commercial Depression.
Probable checking use of Water for Manufacturing, etc., and checking increase of Population
Revival of Business.
With probable largely increased use of Water for Manufacturing and for Business Purposes.
Deficient High Service Pumping Capacity reducing Pressure and Checking Consumption
1884. 1885. 1886. 1887. 1888. 1889. 1890. 1891. 1892. 1893. 1894. 1895. 1896. 1897. 1898. 1899. 1900. 1901. 1902. 1903. 1904.

FIG. 1.—TOTAL CONSUMPTION AND WASTE OF CROTON, BRONX AND BYRAM WATER IN NEW YORK (MANHATTAN AND THE BRONX), 1884-99.

Based on recomputation of flow by J. R. Freeman, M. Am. Soc. C. E., December, 1899, from data furnished by G. W. Birdsall, Chief Engineer Department Water Supply; by A. Fteley, M. Am. Soc. C. E., Chief Engineer Croton Aqueduct Commission, and from daily records of depths in aqueducts by keepers at Croton Dam, Sing Sing, Tarrytown and Central Park, with tables of aqueduct flow corrected in accordance with gagings by F. W. Watkins, M. Am. Soc. C. E., Assistant Engineer Aqueduct Commission, on New Aqueduct, Nov. 25-26, and Dec. 4-6, 1899, and on Old Aqueduct, Dec. 15-16, 1899; also probable consumption for next five years, if rate of increase is same as for the past.

There are strong reasons for expecting that consumption (and waste) will follow this upper line A-D-E unless (1) Water meters are attached to substantially all service pipes; (2) A Department of Water Statistics and Water Waste Prevention is established; (3) The systematic search for and replacing of old and leaky service pipes and mains is vigorously prosecuted; (4) Distribution pipes are subdivided into numerous small districts with arrangements by Venturi meters, Deacon meters or other appliances for measuring in bulk the total supply drawn into each district.

With the greatest progress that can be reasonably expected in prevention of waste the consumption will probably not be decreased below present consumption within these next five years, because of (1) the time needed to educate the ordinary householder that general introduction of meters is to his benefit; (2) the time needed to establish systematic search for leaks and the great territory to be covered; (3) the large expenditure and extensive work needed for rearrangement of pipes for measuring supplies sent into the various districts.

Average Daily Consumption, in Million Gallons, of Croton, Bronx and Byram and Both Sources, 1884, and 1889-99, Inclusive with Forecast for Next 5 Years.

Year	1884.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Croton	84	86	103	142	155	165	163	166	186	197	207	226	242	256	270	284	297
Bronx and Byram	..	16	16	11	8	10	13	14	15	15	19	20	18	18	18	18	18
Total	84	102	119	153	163	175	176	180	201	212	226	246	260*	274	288	302	315

*Although the Bronx and Byram have doubtless yielded 20,000,000 gallons per day in recent years, recomputation indicates safe yield in a series of dry years as not over 17,000,000, or perhaps not over 15,000,000 gallons per day. Therefore, in projecting line into the future, the deficiency is thrown on the Croton, and 2,000,000 gallons per day added to line.

Night after night the rate of consumption at 3 to 4 a. m. did not fall below ninety gallons per inhabitant per twenty-four hours, averaging about ninety-four, while the highest point reached during working hours averaged at the rate of 137 gallons per inhabitant per day.

Thus the excess of consumption in the most active hour of the day was only at the rate of forty-three gallons per inhabitant per twenty-four hours over that in the quietest hour in the night. The average of the whole twenty-four hours was only twenty-one gallons per inhabitant greater than the draft at 3 o'clock in the morning.

Late on Sunday night or early on Monday morning we would naturally expect the consumption to be at its minimum for at that time domestic use is practically nothing, house tanks will have nearly all become refilled through the higher pressure of Sunday, the factory tanks will also have become refilled, and almost the only legitimate use that can be imagined after Sunday midnight is that of the water required for the comparatively few newspaper offices, the filling of boilers for steam heat in some few buildings, a small quantity for electric light stations, and a little for hospitals or an infrequent household in which there is sickness, and for a house tank here and there which has not had time to become entirely replenished. After midnight, from 1 to 4 a. m., the record on Monday, December 11th, almost exactly reproduces that on Monday, December 4, in showing a draft at the rate of 95 gallons per inhabitant per day at this hour when legitimate use should be at its minimum. Granting that this measurement was correct (which we have no good reason to doubt) the simplest common sense shows that a large part of this large draft from the reservoirs at this quiet hour of the night must have been waste through leaky plumbing, leaky street mains and leaky and abandoned service pipes, and making the greatest reasonable allowance for uncertainty in measurement and for legitimate use at these hours, we are, I believe, forced to conclude that water was running to waste at night at the rate of 80 gallns per inhabitant per 24 hours.

A part of this waste must be regarded as incurable, for with the very best of pipe laying, it is found that the small undiscovered leaks in the thousands of joints, aggravated more or less by expansion and contraction under temperature changes and by settlement of the earth around the pipe causes leakage which in the aggregate is considerable.

In the city of Fall River, which has the distinction of water-works the most thriftily managed of any of equal size in the United States and where there is a meter on substantially every tap, domestic, manufacturing, public and commercial, and where close account is also kept of the water used for fires, flushing of streets, and the like, the discrepancy between the water pumped into the mains and that shown as taken out of the mains by the aggregate readings of all the service meters, and after making allowance for under-registry of meters, has not been brought below 6 gallons per inhabitant per day.

In Woonsocket, Rhode Island, another thoroughly metered manufacturing city with a population of about 28,000 supplied, the total water unaccounted for between the pumps and the service meters was in 1898—8.5 gallons per inhabitant per day; in 1899—7.8 gallons per inhabitant per day.

In two small districts of Boston, mentioned in the main reported, very thorough work for about five months with the Deacon system of waste prevention, starting with a night consumption at the rate of forty gallons per inhabitant per day, brought this down to a rate of 10 gallons per inhabitant per day.

Under equal quality of pipe laying and calking of joints, the waste through joints in the cast iron mains should be proportional to the aggregate length of these leaded joints, and the service pipe leakage between the mains and the cellar wall should be proportional to the number of service pipes.

Computation shows that the population along the New York distribution pipes is so much more concentrated than in any other American city, that the per capita waste from joint leakage in the street mains ought therefore to be very much less than found elsewhere. For example, it appears that the total number of pipe joints in Manhattan is not far from 350,000, and that the lineal feet of leaded pipe joints is not far from 1,250,000 to 1,500,000 ft., or, at most, there is only about 0.7 ft. of leaded pipe joint per capita in Manhattan and The Bronx, while in Fall River a similar computation shows 1.1 ft. of leaded joint per capita, and Providence—2.7 lin. ft. of joint per capita, or 4½ times as much as in New York. The number of service pipes per 1,000 inhabitants is only about one-half as great in New York as in certain fully metered cities, like Providence, Fall River, Worcester and Woonsocket, in which the consumption of water is less than one-half that in New York.

Judging from all the data, five gallons per capita is considered ample for incurable leakage, were it not for conditions peculiar to the crowded streets of New York, on which account ten gallons is assumed.

In 1898, there were 35,442 meters in use in New York, covering "every place where water is used to any considerable extent for other than domestic purposes." A careful study of record for several years in the offices of the Water Register and Bureau of Arrears, indicates that 24 of the 116 gallons per capita consumption is metered. Deducting curable and incurable waste, as shown by the reservoir gagings, of 80 gallons, leaves 12 gallons per inhabitant per day as the real domestic use of water. This compares well with the actual records from a number of metered cities, such as 11.2 gallons in Fall River, 16.3 in Lawrence, 14.1 Woonsocket, and 14 in Worcester. The figures for these four cities include "such domestic waste as the average man permits to exist when he has a water meter in the cellar to quicken his memory and his interest in the repair of leaks."

Mr. Freeman believes that a very large number of inhabitants use small quantities of water each and cites averages of many readings made for Mr. Dexter Brackett, ranging from 7 gallons per capita for 619 families in cheaper grades of houses in Newton, Mass., to 35.6 gallons for 31 high-priced apartments, also in Boston.

With waste prevention as well managed as in Fall River, Mr. Freeman thinks the real use and incurable waste of water in New York would be 55 gallons, divided as follows:

	Gallons
Commerce and manufacturing	24
Domestic	15
Incurable waste outside houses	10
Under-registry of meters	3
Public uses	3
Total, each, for 2,000,000 people	55

These figures allow 61 gallons for curable waste, besides the 10 for incurable waste, or 71 for all waste, whereas the Central Park figures indicated 80 gallons.

A tentative distribution of waste in the order of magnitude, is given by Mr. Free-

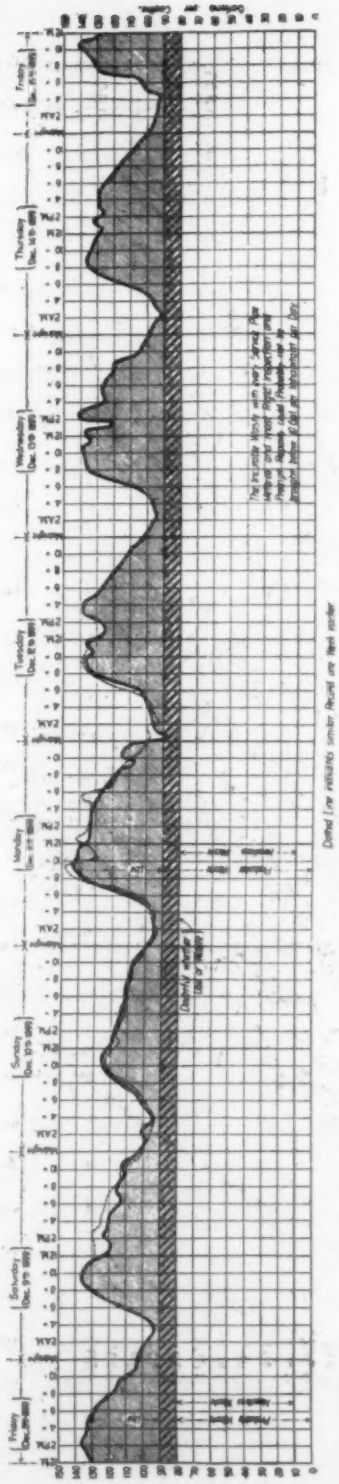


Fig. 2. Waste of Water in New York as determined by gagings of the Central Park Reservoir and New Croton Aqueduct.

man as follows: (1) Leaky house plumbing; (2) old, leaky and abandoned service pipe, outside the house; (3) faucets left open "by careless 10 per cent. or 20 per cent. of the householders;" (4) possibly a relatively small quantity through surreptitious connections.

Of the 50 or 70 gallons of waste, probably 30 to 50 gallons is due to defective plumbing and careless and wilful waste inside of buildings, "a waste from 3 to 4 times as great as the total actual use in the fully-metered cities." This may be called house waste, and two-thirds of it debited to poor plumbing. As to poor plumbing, its remedy, popular objections, and the answer thereto, Mr. Freeman says:

The greatest cause of house waste is undoubtedly cheap and neglected plumbing fixtures, and among fixtures tank ball-cocks are doubtless the greatest cause of leakage. The fastening of cocks open, letting the water run unnecessarily, is also a great source of waste. One cause of the smaller consumption in certain English cities is probably the rigid requirements for inspection of plumbing fixtures. In certain of the English cities every fixture must be officially inspected, approved and stamped before a plumber can use it, and this is believed to have greatly lessened the waste.

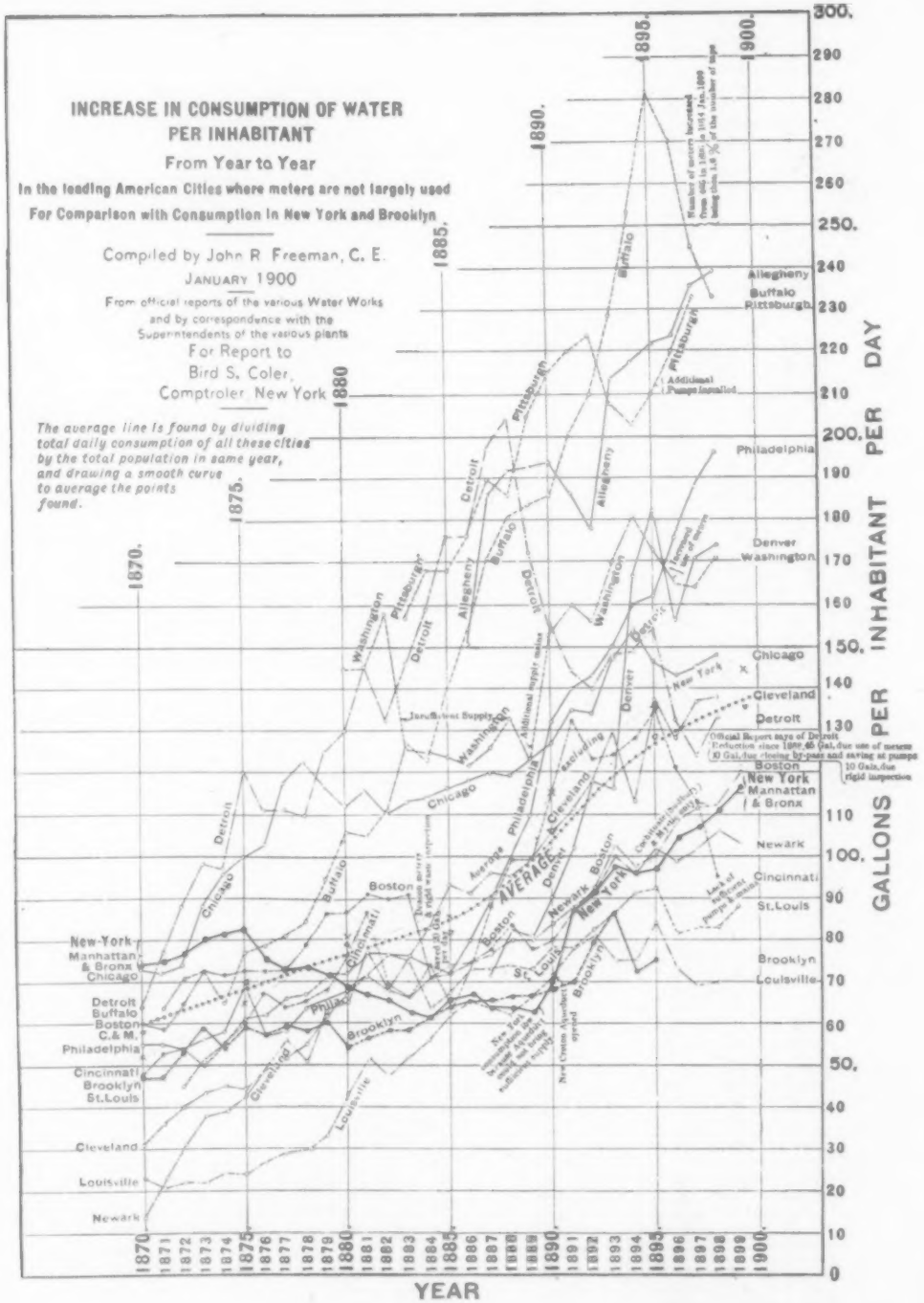
Brightly polished fittings all look very much alike when new and considerable loss results in time from those which are light or soft or of cheap design, but with the compression cocks shutting against leather or rubber or fiber discs, common in all American plumbing, it is more often a question of neglect to apply a new disc or washer than of leakage caused by wear or yielding of the metal.

For the underground plug cocks, the corporation cock, or the cellar stop and waste cock, there is a temptation to cheapen the cost of manufacture, by adding lead to the mixture of tin and copper or to use the cheaper alloy—soft "yellow brass," consist-only of a mixture of spelter and copper, thus giving a metal which can be worked in the lathe at high speed and with broad cuts.

The experience in those American cities which are fully metered and whose domestic consumption has been already quoted appears sufficient proof that each householder will become a fairly good inspector of leaky plumbing if he has a water meter in the cellar, and that reputable plumbers will supply their customers with proper fixtures without the inconvenience and expense of a government inspection, if the customer finds it to his pecuniary advantage to prevent waste of water through leaky fixtures.

The great objection urged against meters is the fear that they will tend to a harmful restriction of the use of water in the houses of the poor or in tenement blocks where the landlord may not be of the most liberal class and would try to save water, if metered, at the expense of his tenants' comfort and health. This is a matter which can, I believe, be solved after proper study by some system of separate meters, combined with a carefully considered scale of minimum charges. The reliable answer is found in the test of experience. No complaint, so far as I am aware, now exists in Fall River, Providence, Worcester, Lawrence, Syracuse or Poughkeepsie that the comfort or health of any class in the community suffers because of the complete application of meters.

The waste underground in the streets of New York is, as a guess, 20 to 25 gallons per inhabitant a day. To locate and stop the


INCREASE IN CONSUMPTION OF WATER
PER INHABITANT
From Year to Year
In the leading American Cities where meters are not largely used
For Comparison with Consumption in New York and Brooklyn
Compiled by John R. Freeman, C. E.
JANUARY 1900
From official reports of the various Water Works
and by correspondence with the
Superintendents of the various plants
For Report to
Bird S. Coler,
Comptroler New York
The average line is found by dividing total daily consumption of all these cities by the total population in same year, and drawing a smooth curve to average the points found.
GALLONS PER INHABITANT PER DAY
YEAR
AVERAGE
New-York Manhattan & Bronx
Chicago
Detroit
Buffalo
Boston C.& M.
Philadelphia
Cincinnati
Brooklyn
St.Louis
Cleveland
Louisville
Newark
Allegheny
Pittsburgh
Washington
Denver
New York Manhattan & Bronx
Official Report says of Detroit Reduction since 1897 65 Gal. due use of meters 10 Gal. due closing by-pass and saving at pumps 10 Gain, due rigid inspection

leaks in the 1,500 miles of cast-iron mains and 200,000 services of Manhattan and Brooklyn would require, Mr. Freeman believes, "twenty years of steady, patient, broadly-planned work," including with the above the finding, digging up and plugging off of some 25,000 abandoned services, "a part of which are without doubt leaking badly, and all of which are likely to leak sooner or later."

The first step recommended toward the stopping of the enormous waste shown to exist, is a subdivision of each borough into districts with an area of, say, ½ sq. mile, controlled by three gates; one gate to be in reserve and two provided with Venturi meters. By means of a variety of records, such as day and night and five-minute readings occasionally, and the population (1900 census), each district could be studied in detail and the aggregate for all the districts checked against the aqueduct delivery.

Having picked out the districts showing most waste, these should be completely metered, and at the same time all water used for public purposes should be determined. This done, "there would be for the first time in New York, definite knowledge of the amount of leakage out through all the leaky joints in main pipes and throughout all of the old, leaky and abandoned service pipes. The next step would be to subdivide the Venturi meter districts, and, being provided with large scale maps showing locations of all mains, services and gates, with their age where possible, make a thorough-going study of these smaller districts with the aid of Deacon meters. Unfortunately, this would locate leaks by blocks only, because of the absence of the usual curb stop-cocks on services in New York. Besides this, little permanent relief could be expected from the Deacon system in New York. Boston did cut down the consumption from 91.5 gallons per capita in 1883, to 68 gallons in 1884, but it has risen since, until in 1899 it averaged a little higher in Boston than in old New York. Another objection to the Deacon system, as a permanent thing, is the corps of skilled observers it requires. This is to some extent true of house to house inspection, but in addition the latter is very objectionable to householders." Mr. Freeman's final conclusions as to the best remedy for waste deserve the most careful consideration, particularly his recommendation of public ownership of both meters and the service pipes therefrom to the curb, and the proposition to have fewer services beneath the roadways: "After having studied into these matters as thoroughly as possible in the time at my disposal, I am, from the evidence found in New York and in other cities, forced to conclude that the one efficient, practical and economical method of preventing waste begins with a meter on every service pipe domestic as well as commercial. At the same time it must be admitted that public sentiment in New York, as in Philadelphia and other large American cities, appears to be almost hopelessly against the universal application of domestic meters, for fear that in tenement houses the health of the people will suffer from injurious restriction of water and discouragement of cleanliness. That this comes from lack of understanding the matter fully I have no doubt. It is my further opinion that the city should, at its own expense and through its own workmen, put in all meters and that the meters should be periodically tested and kept in repair by the public water department, and that the city should furthermore put in at its own expense and maintain all service pipes between the meter and the street main, and that systematic work in this direction should at once be begun, looking toward the city examining and replacing all service pipes of whose tightness there is any doubt, at some fixed rate of progress per year, looking to the entire overhauling and remodeling of these within a period of say twenty years, relaying them with fewer main arteries under the roadway, branching near the curb into the several buildings and with a curb stop-cock on the pipe into every building, at the same time making all new pipe thick and strong enough to stand a future working pressure of 100 pounds per square inch. Taking the work up in this manner, systematically, with the aim and end continually kept in view, of having all doubtful pipes relaid and made good within twenty years, would not burden the water debt revenues seriously and the twenty years would quickly pass."

Probable Future Daily Requirements for Additional Water Supply of New York under Ideal, Probably Attainable and Present Conditions.

Year.		Manhattan and The Bronx. (U. S. gallons.)	Brooklyn and Queens. (U. S. gallons.)	Richmond. (U. S. gallons.)	Total all boroughs. (U. S. gallons.)
1910..	Probable population	2,600,000	1,800,000	90,000	4,490,000
	Additional supply required with greatest waste restrictions probably attainable. (Meters on one-half the domestic taps underground leak as much as at present.)	48,000,000	73,000,000	6,000,000(?)	127,000,000
	Addit'l supply needed under present conditions	113,000,000	109,000,000	8,000,000(?)	230,000,000
1920..	Probable population	3,200,000	2,200,000	130,000	5,530,000
	Additional supply probably required under ideal conditions of waste restriction	...	31,000,000	7,000,000	38,000,000
	Additional supply needed under best waste restriction probably attainable	158,000,000	132,000,000	12,000,000	302,000,000
	Addit'l supply needed under present conditions	286,000,000	203,000,000	14,000,000	503,000,000
1930..	Probable population	3,800,000	2,600,000	175,000	5,575,000
	Additional supply probably needed under ideal conditions of waste restriction	14,000,000	68,000,000	10,000,000	92,000,000
	Additional supply needed under best conditions practically obtainable	280,000,000	198,000,000	19,000,000	597,000,000
	Addit'l supply needed under present conditions	470,000,000	302,000,000	23,000,000	795,000,000

The universal meter system, he says, "is slowly but steadily gaining ground in the smaller American cities," all or a large percentage of taps now being metered in Fall River, Woonsocket, Providence, Worcester, Syracuse, Lawrence, Lowell, Milwaukee and Poughkeepsie. Everywhere the system has greatly reduced waste. The recent consumption per capita in these cities, notwithstanding much higher pressures, in some cases, than are maintained in New York, ranged from twenty-nine gallons for Woonsocket (some factories supplied direct from river) to sixty-eight gallons for Worcester. Practically all the services at Woonsocket and 94 per cent. at Worcester are metered. All the Woonsocket consumption and waste is measured at the pumps, while at Worcester it is recorded by a Venturi meter. At Worcester the service meters showed that of the total

consumption seventeen gallons per capita were used for manufacturing, fourteen for domestic and thirty-seven for public uses or not accounted for.

Other recent estimates for new supplies for large populations were 150 gallons for Philadelphia, every tap to be metered; 130 gallons for Cincinnati, and 100 gallons for the Boston Metropolitan district. The latter estimate was made by Mr. Dexter Brackett, M. Am. Soc. C. E., who, Mr. Freeman says, "probably has a richer fund of experience in water waste prevention to draw upon than any man in the United States." This 100 gallons per capita Mr. Brackett divided into thirty-five gallons for domestic use, thirty-five for manufacturing, five for public use and twenty-five gallons for waste. Four years later, or in 1899, the actual consumption in this district was 110 gallons, showing that "the reasonable and proper restriction of waste hoped for by Mr. Brackett has unfortunately not yet begun."

Mr. Freeman concludes that a source of additional supply should be sought immediately capable of furnishing at least 500,000,000 gallons a day.

Instead of proceeding along narrow lines, it is recommended that New York follow the plan pursued for Boston and vicinity, and make a comprehensive study of the needs and possible supply at a date far in the future.—Engineering News.

CURRENT INFORMATION.

Improvements That Do Not Conflict with the Federal Constitution.

Judge Wood of the Circuit Court of St. Louis, Mo., rendered a decision, April 2, in the suit of Charles M. Hays vs city of St. Louis and Hill & Abbott, to restrain the collection of a special tax bill of $1,385.18 for the construction of the De Hodiamont sewer. It was alleged that the tax bill was invalid under the decision of the United States Supreme Court, in the case of Norwood vs. Baker; that the sewer, although constructed as a district sewer, was a part of the public sewer system of St. Louis, and the cost of the construction should be paid out of the public revenue, and could not be charged against the property in the district; that the ordinance under which the sewer was constructed failed to provide the materials and regulations for the construction of the sewer, or for the connection of the sewer with a public sewer or some natural course of drainage as required by the city charter; that the city failed to take certain steps tending to a reduction of the tax bills.

Judge Wood held that the case was different from the case of Norwood vs. Baker. The procedure in that case was in contravention of the fourteenth amendment of the United States constitution, which provides that no state shall deprive a person of property without due process of law, while the present case involves the power of taxation for local improvements. Judge Wood states that an act of legislature or an ordinance of a city within its charter powers, passed under the power of taxation for local improvements is not violative of the fourteenth amendment of the United States and does not deprive a person of his property without due process. It is not essential to due process of law in such a case that the owner of a lot be given an opportunity to be heard on the question of benefit to his lot, nor is the act unconstitutional because it procures the tax or benefit according to the front foot or acreage rule.

Sections 21 and 22 of article 6 of the Scheme and Charter invest the municipal authorities of the city of St. Louis with authority by ordinance duly enacted to construct public and district sewers, the court states, and whether such discretionary power is rightfully exercised in establishing a district sewer will not be inquired into in a collateral proceeding. If an ordinance establishing a sewer is the offspring of fraud or caprice, the courts, in a proceeding brought for that purpose, will pass upon the validity of the ordinance.

It is not essential, the court continues, that it should be stated on the face of an ordinance establishing a district sewer that the sewer shall connect with a public sewer or a principal course of drainage. The court also holds that the ordinance in question is sufficiently explicit in specifications in regard to material used in the construction of the sewer and manner of construction. City took proper steps tending to reduce tax bills. The petition was dismissed with costs.

Typhoid Reduced by Water Filtration

A report by Dr. S. S. Cox, health officer at Lorain, O., contains figures showing that mechanical filtration of water has had a marked influence on the typhoid fever death rate of the city. In 1892 sewage was first discharged into the lake from which the water supply was drawn. Typhoid soon claimed so many victims that the authorities became alarmed, and in February, 1897, put in service a battery of six Jewell filters, with the result that the number of deaths yearly was reduced from 11 and 15 to 3 and 4.

Defective Stone Roads at Fitchburg, Mass.

In his annual report for 1899, David A. Hartwell, city engineer of Fitchburg, Mass., opposes the common local practice of laying

cobblestone of varying sizes for a foundation and covering them with 3 to 4 ins. of broken granite. While it is somewhat less expensive than a macadam road of 6 to 8 ins. of broken granite, yet it wears out more rapidly. This is at least true in Fitchburg.

A Property-Owner's Effort to Escape a Paving Assessment.

The Iowa supreme court rendered a decision April 13 affirming the judgment of the district at Burlington, Ia., in the case of W. O. Ransom vs. the city of Burlington. Ransom sought to escape an assessment for paving Grand-st. with brick by the conveyance of a fifteen-foot strip along the Grand-st. front of his property to Charles G. Perkins of Chicago, a relative of his wife, thinking thus to free himself from the tax. The plaintiff frankly admitted in the trial that his only object in making the transfer was to escape the paving assessment and that there was no other consideration. Further evidence showed that the plaintiff endeavored to have the property reconveyed to him, and still regarded himself as the owener. The court held that the conveyance was invalid.

Taxation of a Gas and Electric Lighting Company.

Judge Budd of the superior court, Stockton, Cal., rendered a decision in the case of the Stockton Gas and Electric company vs. the county of San Joaquin to recover taxes paid under protest on its franchise. County Assessor L. L. Ortman assessed the franchise in 1897 for $164,519, but the state board of equalization reduced it to $24,000, and the taxes on this amount were paid under protest. A year later Assessor Ortman placed the figures at $115,108, and the same procedure followed. The gas company contended that its franchise was assessed at the corporate home of the company in San Francisco for $1,000 and that it could not be included in the local list of property. The board of equalization refused to lower the assessment this time. Judge Budd holds that the rights to the streets granted by the city constitute a franchise which can only be assessed in the county in which such franchise exists.

Ownership of Water.

The Utah supreme court has rendered a decision in the case of the Willow Creek Irrigation company and A. N. Bjeragaard, appellant, vs. Sarah C. Michaelson, in which it affirmed the judgment of the district court in favor of the defendant. The plaintiffs, claiming to be the owners of the water of Willow Creek, Iron county, asked for an injunction to prevent the defendant from diverting and using the water. The defendant owned the land under government patent, from which a portion of the water which supplies Willow Creek flowed. The water was not visible on the land when the patent was obtained, but it afterward appeared and constituted a considerable flow, and this was the water diverted by the defendant. The trial court held that the defendant or owner of the land owned the water also, and gave judgment in her favor, and the supreme court sustained this decision.

Water Waste at Bradford, Pa.

The extension of the meter system in Bradford, Pa., is recommended by S. D. Heffner, superintendent, as a preventive of further waste and as a more equitable method of selling water than the present schedule against which there are so many complaints. Until meters are generally introduced, he recommends regular inspection as the next best method of checking water waste. The city has about 3,390 services and a recent inspection of water fixtures showed 358 closets and 79 faucets to be leaking.

No Exclusive Use of a Public Bridge.

A decision rendered at Pittsburg, Pa., April 3 in the Smithfield street bridge case lays down the rule that street railway companies cannot acquire exclusive privileges in the use of a public bridge. A supreme court ruling will probably be required to finally establish the principle.

Illegal Procedure in Making an Improvement.

The Iowa supreme court sustained Judge Hustedt's decision in Altman et al. vs. city of Dubuque, April 13. This was an action to enjoin the city form collecting a special assessment for the improvement of Grandview-ave. on the grounds that the mayor had not signed the resolutions ordering the improvement and that the contractor had not performed the work according to specifications. The amount involved was about $15,000, including interest. The court holds that the improvement bonds issued on account of this improvement will have to be paid out of the general fund.

City Restrained from Regulating Water Rates.

Judge Shiras handed down a decision April 16, in the Cedar Rapids water case, in which he perpetuated an injunction restraining the council from regulating the water company's rates. The company's charter has expired since the temporary injunction was issued, but the court covers the present status by holding that the right to regulate water rates can be acquired through contract only. Judge Shiras suggested that the city and the company should try to agree. The city, however, is negotiating for a new plant, having refused to buy the present one. As the situation now presents itself the city may take water from the company if it desires to and the company may supply the city if it desires to. There is now no contract between the city and the company.

A City's Attempt to Take Advantage of an Anti-Trust Law.

A decision has been handed down by Judge Kohlsaat, in the United States Court, in the case of the Lafayette Bridge company against the city of Streator, Ill., in which the plaintiff tried to recover $40,000 for failure to pay the contract price for the construction of a bridge over the Vermillion river. The city of Streator refused to pay on the grounds that the plaintiff is in a combination. This contention in the plea of the defendant was sustained by Judge Allen of the United States Court last May. Judge Kohlsaat intimates that his opinion is adverse, but he says it is unnecessary at the present time to pass upon the constitutionality of the statute. He holds that the anti-trust statute can not be availed of in a collateral proceeding until a determination has been made in a direct proceeding establishing the fact that plaintiff is a trust in contravention of the statute.

Litigation Over the Diversion of Water.

Suits have been instituted against the city of New York by five local baymen because of the diversion by the city of water for the borough of Brooklyn, which would otherwise flow into Freeport creek. The total amount of claims is $75,000. Each alleges in his complaint that he has for many years gained his livelihood by means of the Freeport creek, as bayman, oysterman and boatman; that the creek in its natural condition was well adapted for carrying on such business, having abundance of water to enable each of the complainants to go out and come in from the bay with boats; that the construction of a conduit a few years ago by the city of Brooklyn for the purpose of conducting water in large quantities to that city from Freeport and places adjacent, and the operation of two pumping stations, which pump large quantities of water to Brooklyn and sold for various purposes, has caused the bottom of the creek to become bare in many places and its character and condition have become greatly changed.

Iowa's New Paving Law.

The new paving law passed by the Iowa Legislature is severely criticised by the press of that state. The provisions of the law are in brief that no property shall be assessed out of proportion to the benefit received from the improvement; that no property shall be assessed more than 2 per cent. of the valuation as shown by the books of the assessor; that the remaining cost of the improvement shall be paid from the general fund. It is said that the property that would be assessed for this general fund would probably fight the law under its own provision stating that property should not be assessed for more than the value received.

Interest of Business Men in Public Improvements.

Municipal improvements received their share of attention at the installation of the new officers of the Business Men's association at Evansville, Ind., April 10. Frank Foster, a member of the city council, suggested that as the constitutionality of the Barrett law is in doubt, thus preventing the improvement of streets, the association arrange a plan of street improvement to be presented to the next legislature and work for its passage so that street improvement can be obtained. The question of water filtration was also discussed and unanimously favored by the association. C. J. Murphy, secretary of the association, said that one of the great defects in the physical appearance of the city is the poor character of its sidewalks and urged improvement in that direction.

Road Making in Massachusetts.

In his report for 1899 Charles Mills, chief ergineer of the Massachusetts Highway Commission, describes road building and maintenance in Massachusetts. He says the commission's standard thickness of macadam, 6 inches after rolling, seems to be ample for the heaviest travel, provided the sub-soil is sand or gravel and well drained. Where the drainage is poor the thickness should be increased or side drains laid. On clayey soils good sandy gravel has been used in place of telford with good results. At one place 6 inches of broken stone as it came from the crusher was used as a foundation, as gravel would have to be hauled a long distance, and the stone, although poor, was abundant and cheap. Roads built of screened gravel in Brimfield, Colrain and Boylston have given satisfaction, but show the wearing effects of travel. This type of road is not considered economical, as the saving of cost in this construction over that of a macadam road will not equal the increased cost of maintenance. Where the commission has built gravel roads it has generally been at the request of local authorities. When first built these roads give satisfaction, but later, when the wear is evident, the local authorities regret that they did not ask for the macadam at first. Gravel can be of no better quality for road purposes than the ledge stone in the same vicinity. Where the stone is soft gravel obtained in the same vicinity does not wear well. Roads surfaced with native stone other than trap rock consolidate under the roller more quickly than when trap rock is used. Such roads wear sufficiently fast to supply building material, and as the stone does not unravel, they at first give good satisfaction. But they wear rapidly, and unless the stone is of a uniform grade the harder portion is in time left above the softer, and resurfacing becomes necessary. The use of trap rock is recommended in all cases where

its cost is not expensive. This material, when used for surfacing, requires two or three times more rolling than native stone. Frequently, after such a road is opened to travel, unless a large excess of screenings is used in its construction, or unless it is watered daily for a few weeks after completion, the stone becomes loose, and rerolling and watering are necessary. Where this is the case the road is sometimes condemned by the public as being poorly built, but after the surface becomes compact by the travel the road improves, while one built of native stone, other than trap, deteriorates.

In order to compare the volume of material as measured in the pit before the excavating and in carts, eight double and three single carts used on one of the state roads were measured. The former varied in size from 36 to 53.67 cubic feet, averaging 44.50 cubic feet, or 1.648 cubic yards. The latter averaged 24.72 cubic feet, or 0.915 cubic yard. The average load hauled by the double carts, according to the pit measurement, was 1.404 cubic yards, showing a shrinkage of 14.8 per cent. That for a single cart was 0.776 cubic yard, giving a shrinkage of 15.1 per cent. The measurements of the carts included the side-boards. The material moved was sandy gravel and hardpan, the carts were loaded to the top of the side-boards, and were heaped at least 4 inches in the center. The shrinkage shown is the difference between the actual cubic contents of the carts and the quantity determined from the cross-sections of the pit.

The use of oil to lay dust has not proved to be a success. A section of road in Cottage City is peculiarly exposed to sweeping winds, which remove the binding material and make it difficult to maintain the road in a satisfactory condition. For this reason it was thought to be a good road on which to experiment with oil, the supposition being that this would prevent the removal of the binding material by the wind. The total length treated was 1,800 feet, and the width was 8 and 15 feet. The entire cost, including transportation, labor, etc., on a basis of 50 gallons of oil per 100 linear feet and a width of 15 feet, was $4.35 per 100 linear feet of road.

The oil was applied in June, and was at first thought to a great success, as no dust blew from the section treated, while on the rest of the road it blew in clouds. The good effect, however, was not lasting. A month later the stone began to unravel, and it was necessary to spread binding material. There was also some complaint that the material thrown into carriages by the wheels injured the robes and clothing.

No serious damage was caused by floods or freshets during the year. The work of maintenance consisted principally of cleaning the gutters and placing binding material on roads traveled mostly by light vehicles, and on those where the binder is removed by the wind faster than the wear on the stone supplies it.

Inequitable Financial Management of Municipal Water Works.

In his annual report John H. Perkins, superintendent of the water department, Watertown, Mass., makes a strong plea for justice to the water consumers of the town. The department is not paying expenses, and whatever revenue there is comes from the private consumers. The injustice of this course is objected to by the water board, which points out that it is unfair to make consumers, who do not represent all the owners of property in the town, pay for the fire protection of all the public and private property. If the works were operated by a private corporation, the consumers would make such a strong objection to this course that the town would have to pay for hydrant rental. Objection is also raised to the refusal of the selectmen to pay for water for the town departments. It is claimed that water is supplied to schools, for example, that it is furnished for general town purposes and should be paid by the school department just as much as coal or the salaries of the teachers. To compel the portion of the residents who pay rates to bear all this expense is to tax a few for the benefit of all.

Iron Eliminated from Water by Mechanical Filteration.

The report of Lewis M. Bancroft, superintendent of the water department at Fitching, Mass., for 1899, states the removal of iron from the ground-water supply, by mechanical filtration, was conducted with the following results:

Iron removed on Jan. 9, 96.27; Feb. 6, 91.06; March 8, 94.09; April 10, 90.06; May 6, 89.09; June 6, 87.05; July 6, 97.50; Aug. 7, 98.82; Sept. 5, 97.77; Oct. 11, 99.16; Nov. 5, 98.82; Dec. 11, 98.50.

Engineers Required for Efficient Road Construction.

The Massachusetts Highway Commission has requested the general court to reorganize its personnel so as to make its work more efficient. The commission consists of Dr. T. C. Mendenhall, president of the Worcester Polytechnic institute; W. E. McClintock, M. Am. Soc. C. E., and Charles W. Ross. The commission is a salaried one, and its request is, for that reason, a novel and rare one, for its recommendation strongly urges that the commission consist hereafter of two "highway engineers of experience and recognized high standing," who will give all their time to the state road work, and a third commissioner, the president, who will give but a part of his time to such duties. To comply with this request will, therefore, legislate two members of the commission out of office. The commission has held sixty-eight regular

meetings in Boston and others elsewhere in the commonwealth during the last year. At least one meeting was held in every county, and about 200 special meetings were given in Boston. On account of the method of conducting such hearings, which are prescribed by the general court, these meetings have sometimes been of little value to any one. The demands made upon the time of the commissioners have become too heavy to be borne by men of other large affairs, and the work has increased so largely that they cannot have the thorough knowledge of all the operations of state road work, which is so desirable. The present system of organization is neither attractive to the right men for commissioners nor profitabe to the commonwealth. To make the commission an engineering body seems the best remedy. The state is to be divided into two districts, each under a commissioner, who is to be an experienced engineer of highways. He will be given large powers, so that the meetings of the whole commission need not be fritted away in details. A salary of $5,000 is suggested as a suitable compensation for the entire time of such an official. The salary is about that which is now paid to the chief engineer of the present commission. The third member, the chairman, is to be well enough informed concerning the general status of the work to vote intelligently upon the problems which come before the whole commission. His general duties, however, will be to superintend the financial and office work. As this will not call for much of his time $1,000 is suggested as an adequate salary. The commission points out that this change can be made without any increase whatever in the expenses for management, and will "very greatly increase the efficiency and economy of administration."

The Attitude of Municipal Corporations Toward the Public.

In an address before the recent meeting of the Southwestern Gas, Electric and Street Railway association on "The Attitude of Municipal Corporations to the Public" Mr. J. G. Boyd of Terrell, Tex., said:

"When we go before a municipal corporation and ask franchise privileges and the municipal corporation grants our request in its entirety as desired, we are inclined to feel that their 'attitude' is most gracious and just, but, when they mulch us out of several per cent. of our gross earnings in the way of free services or a certain per cent. of gross earnings as a condition precedent to the granting of such franchise rights, it is believed to be an embodiment of human nature to strongly condemn 'the attitude of municipal corporations to the public.' It is confidently believed that in many cases of municipal failure, a private company would not only have been successful from a dividend standpoint, but, would have also afforded the public satisfactory service. It hardly seems fair or just to presume that in the generality of cases the municipal body is lacking in the possession of at least one or more enterprising business men, hence were that faction to look after the public trust with the same care and close attention to all details that they give their commercial enterprises, success all along the line would be the natural result. The stern school of experience, however, has demonstrated time and time again that while men of that stamp mean to bestow the same care, time and attention upon municipal matters that they do on their own commercial enterprises, they are debarred from so doing by the lack of necessary time, or balked by a designing ward heeler.

"In several instances when the writer was selling and erecting electric light plants throughout the country he was asked his opinion of the feasibility and desirability of municipal ownership, he seldom had but one reply to make to the query and that was this: 'Do you, sir, realize that when you cast your vote for municipal ownership that you have, in effect, mortgaged your property by the proposed issue of bonds, from the sale of which is to be derived the funds to create such an enterprise, by virtue of the fact that you will have to pay interest on those bonds and provide a sinking fund for their final payment?' Of course, many of the voters are not property-owners and are disinterested in that phase of the question, but usually they are in the minority. We all of us understand how the disciple of municipal ownership, in his presentation of the so-called merits of his scheme, is wont to 'paint the lily and throw a perfume o'er the violet;' he represents to them how municipal ownership will reduce the cost of these commodities and the undertaking is entered upon with enthusiasm. In the first few years, or, during the period of dress parade conditions, the showing and the balance sheet certainly appear attractive, then, as extraordinary repairs become necessary, then at once becomes apparent the direct result of political preferment in the selection of a major domo; and the negative era is entered upon with the advancement of many natural reasons therefor. Here is where the non-property-owner commences to pay the fiddler for his dance, earned through the ballot box with his bond-voting ballot in his hand, and, inasmuch as his income is quite limited, in the end he suffers the most, and the longer the industry is operated the harder he is hit by increased taxes."

The New York Water Storage Law.

The water storage bill passed the New York legislature April 6. The bill provides an appropriation of $97,000 for a bulkhead and controlling works, and a lock at the outlet of Seneca lake. The proposed dam will raise the natural level of Seneca lake eighteen inches, and two feet higher than the crest of the Waterloo dam across Seneca river. It is claimed that with the bulkhead installed, manufacturers along the river front will, at all times, have plenty of water power, and that Cayuga and Seneca canal boatment will also be benefited. Factory owners will derive the greatest advantages at the expense of residents on either side of Seneca lake in the vicinity of Watkins. Much of their marsh land is now under cultivation, all of which will be flooded when the water in the lake is up to the proposed new level. This will mean ruin for a number of small land owners. Efforts have been made for years to pass this bill, but it has always met with defeat at the hands of the people living at the south end of the lake, who bitterly opposed

it. The bill awaits the signature of the governor.

Water Works Company Compelled to Supply Water for Fire Protection.

The Urbana, O., water works company and the city have been unable to agree on the terms of a new contract, and the company undertook to dismantle its fire hydrants and served notice that it would refuse to furnish fire portection. The city secured a temporary injunction, which Judge Jones makes perpetual, or for so long as the company continues to use the streets of the city. He holds that the water works company is a quasi public institution and enjoying certain privileges under a franchise from the city, and in consequence is in duty bound to return fire protection for the privileges which it enjoys.

A City Without Water, Light and Police.

The city of Belleville, Ill., was without police and fire protection and in total darkness on the night of April 3. Owing to the depleted condition of the city treasury, the mayor discharged the entire police force, ordered the electric light company to cut off the entire system of street lights, and discontinued the city water service.

Embarrassments Caused by Illegal Special Tax for Paving.

By a recent decision of the Nebraska Supreme court a debt of nearly $70,000 was placed upon the taxpayers of South Omaha. The case was that of Henderson vs. the city of South Omaha. About sixty property-owners decided some time ago to fight the Twenty-fourth street paving case in the courts. A stipulation was made that the decision in the Henderson case should carry all the others with it, as the testimony was identically the same. The supreme court held that the levy of the special tax to pay for the curbing of Twenty-fourth street was absolutely illegal. This prevents the city from collecting any more of the tax. While the exact figures are not known it is believed that at least $70,000 of this tax is unpaid at this time. Those who have paid will have to commence individual suits against the city if they want to get back their money. As the original levy was illegal the outstanding bonds cannot be refunded, and it will probably be necessary to call a special election for the purpose of voting the general indebtedness bonds to take up the bonds now outstanding.

Abolishment of Grade Crossings in Indianapolis.

The ordinance passed by the city council of Indianapolis in August, 1899, declaring grade crossings within the city limits a nuisance, requiring their abolishment and authorizing track elevation, provided that the work of removing grade crossings should begin not later than April 1, 1900. No steps, however, have been taken by the railroad companies toward compliance with the requirements of the ordinance. The Board of Public Works has, therefore, passed a resolution instructing the city attorney to pursue whatever course may be necessary for the enforcement of the ordinance, and City Attorney Kern, on April 21, sent to the officials of the railroad companies a letter notifying them that unless they proceeded with the work in good faith proceedings would be instituted in court against them within twenty days.

Limited Bidding on Public Works.

The action of Attorney-General Griggs in sending out circular letters to certain contractors recently, instead of publicly advertising for proposals, is severly criticised by local contractors and builders of Washington, D. C. This was done in connection with the proposed erection of a new building for the Department of Justice. Congress provided that the Attorney-General should have entire charge of the construction of the building, the selection of plans and the making of contracts, "after proper advertisements and the reception of plans and bids." Mr. Griggs selected George B. Post for architect, and after the plans and specifications were prepared he sent out a circular letter to ten well known contractors in New York, Chicago, Boston, Worcester, Philadelphia and Cleveland, asking them to bid for the work of construction. One contractor asked for permission to bid, but was refused by Mr. Griggs. The bids were opened April 12, the lowest being that of Charles McCaul of Philadelphia, $1,419,543. The same criticism is made in connection with the new penitentiary building at Atlanta, Ga., for which Attorney-General Griggs invited six contractors to submit proposals. Comptrollers of the Treasury hold that a circular letter constitutes an advertisement. Attorney-General Griggs, when asked about the matter, said that in view of the limited time he had pursued the best possible course.

The Color Line on Southern Street Cars.

The Alabama Supreme Court has decided that whites and negroes should occupy the separate portions of a street car set aside for them. A negro woman recently sued a street railway company which enforced this rule for damages for putting her off the car. The lower court decided in favor of the railway company and the supreme court affirmed the decision.

Technical Meetings.

The Civil Engineer's Club of Cleveland met April 10. A paper was presented by Walter C. Parmley on "The Maintainance of Sewerage Systems." At the semi-monthly meeting, April 24, Leon J. LePontois read a paper on "The Evolution of the Modern Gas Engine."

The Connecticut Association of Civil En-

gineers held a meeting at the Sheffield Scientific school, March 30. Desmond FitzGerald delivered an address regarding the general problems of water storage and supply.

The regular monthly meeting of the Engineering Association of the South was held April 12, at Vanderbilt University. A paper entitled "Sketching Topography with the Traverse Table," was read by Mr. R. L. Lund. This method was presented in a clear and interesting manner, comparison being made with the methods now commonly in use; the conclusions reached by the writer being that this method was more accurate, rapid, more easily adapted to varying conditions, and cheaper than the methods now commonly in vogue. Dr. W. L. Dudley spoke on the subject of "Liquefaction of Gases." A brief history of the matter was given, explaining how in earlier times there were certain gases supposed to be permanent, but the discovery of the simple law of Charles and Guy-Lussac convinced scientists that all gases could be liquefied if the proper temperature and pressure could be secured. This led to numerous experiments, with the result that many of the supposedly permanent gases were brought to the liquid state, and the recent development of a machine, simple in construction and operation, whereby air is liquefied, has caused the subject to become a vital one to the public. The varied fields of usefulness of liquefied gases were spoken of, and the possibilities for an increasing demand for such seems certain. Dr. Dudley performed a number of interesting experiments with liquefied carbon dioxide, showing how easily mercury could be frozen into a hammer, and how quickly one's hand could be blistered by a temperature of 160 degrees below zero, Fahr.

Municipal Reports.

Report of the Municipal Council of Shanghai for the year ending Dec. 31, 1899, and Budget for the year 1900. Charles Mayne, Municipal Engineer.

This report is excellent on account of its thoroughness and good form, in addition to which it is curiously interesting as a representation of municipal administration in a distant foreign colony. Much of the first part of it is devoted to what are known as "Watch Matters," connected with the police and military service, which embraces also public sanitation. Under the heading of "Work Matters" the engineer gives a review of improvements, noting among other things that while little has been done in making road extensions during the last year, "the Rev. Pere Bairepaure made a very good survey of a proposed road eighteen miles in length." Much attention was given to the reviewing of defective street gullies, and it is mentioned that "20,000 new gullies have been put down by private owners in alleyways, etc., during the last few years." Attention is being given to the collection and disposal of domestic and trade refuse. During the year 85,570 tons of refuse were collected in the settlement, and analyses has been made of Shanghai garbage in comparison with London garbage for information in considering the erection of destructors. Negotiations were successfully concluded for the extension of the settlement, and this will result in much work for the engineering department, particularly in the making of new roads, protection of streams, improved drainage, etc. The administration is quite up-to-date in many respects, as indicated by references to parks, public gardens, electric lighting, steam rollers, stone crushers, egg-shaped Portland cement sewers, etc. The street paving appears to consist of Portland cement concrete, "chip-paving," Soochow granite, tarred macadam and Ningpo stone. In connection with the street cleaning there is quite free street watering. During the hot weather roads are watered from six to seven times daily. The report, of course, presents nothing of value as an example in modern methods, but shows efficiency in dealing with the conditions surrounding the foreign settlement in China.

Report of the City Water Works of Battle Creek, Mich., for the year 1899. W. W. Brigden, Engr. and Supt.

This report is condensed into a comparative statement in tabular form covering four years, and presents the essential statistical information on a single page. It shows that during the last year the number of meters increased from 1,515 to 1,710, and the per cent. of water metered increased from 71 to 75. The average plumbing expense per 1,000 gallons was 1.2; the average operating expense, 3.2, not including interest, and including interest at 4½ per cent., 7.2. Water used per day is 48 gallons per capita. The average receipts for metered water were 12.5 per 1,000 gallons and for unmetered water (40 to 45 per cent of total free or waste), 4.5. The works are owned by the city. The total receipts for 1899 amounted to $36,750.14, and total expense $22,303.81, leaving a balance of $14,446.33.

Seventeenth Annual Report of the City of Madison, Wis., for the year 1899. John B. Heim, Supt.

Mr. Heim points with gratification to the fact that the water department is conducted with its own earnings. After paying all running expenses, including construction, extension and repairs, the balance on hand at the end of the last fiscal year was $6,553. The pumping machinery has suffered much from mineral qualities in the water and new pumps will be required in the immediate future. The superintendent also notes that the water mains are being affected by electrolysis. Meters were increased during the year from 2,269 to 2,410, leaving 180 water-takers without meters. Mr. Heim's interesting article on "Thawing Frozen Water Pipes by Electricity," is reproduced in con-

nection with the report, accompanied by illustrations.

Report of the Superintendent of Electric Light and Water Works of Moorhead, Minn., for the year ending March 1, 1900. O. G. F. Markhus, Supt.

The report shows a total income of $26,703.87, and operating expenses, including interest and depreciation charges, $25,080.71, leaving a surplus of $1,623.16.

Of the operating expenses $5,200 was for salaries and labor and $8,500 for fuel and oil. The fuel was tamarack wood at from $4.15 to $4.65 per cord. Coal in Moorhead costs $6.60 per ton delivered. The increase in cash receipts was $4.325.33.

Annual Reports of the City Engineer, Superintendent of Parks and Health Officer of the City of Mankato, Minn., for the year 1899.

City Engineer J. R. Thompson reports no important work, but gives data covering the water works and sewer construction, sidewalks, street improvements and street sprinkling.

Eighteenth Annual Report of the Board of Water Commissioners of St. Paul, Minn. John Caulfield, Secy.

The number of meters in use increased during the year 708, and the total number is now 4,063. Among the interesting tables in the report is one showing the number of meters, the estimate of water and amount paid for water, and the average per month covering the last four years. In January, 1896, the number of meters was 1,115 and the average rate paid per 100 cu. ft. .08081. In December, 1899, the number of meters in use was 4,063 and the rate per 100 cu. ft. .0750.

Annual Report of the Bureau of Public Lighting, City of Allegheny, Pa., for the year ending February 28, 1900. D. Hunter, jr., Supt.

The report shows only a slight variation in the operating cost of the arc light service during the last year compared with the previous year. The cost for '98 was $47.71 per lamp and in '99, $47.35, a difference of 8-10 of 1 per cent. in favor of '99. The total cost per lamp is determined by the following charges: Interest at 4 per cent., $9.63; depreciation charges at 5 per cent., $12.04; taxes, less the 50 per cent. valuation, 1.5 per cent. levy, $1.81; volume of water consumed, 34 cents; operating expenses, including insurance, $47.35, making a total cost per arc lamp for a year, $71.17. A credit in the sinking fund earnings of $1.15 reduces the net cost per lamp to $70.02. Many improvements in the system are needed and specific recommendations for these are made by Mr. Hunter. The approximate cost of these improvements will be $100,000.

New Publications.

Logarithmic Tables, by Prof. George William Jones of Cornell university. Published by the author at Ithaca, N. Y. 160 pp. $1.

Prof. Jones has put together in this book a very valuable selection of tables for engineers and others, with few computations to make. The tables include four-place logarithms of numbers and of trigonometric functions and six-place logarithms of the same. Small angles are given in detail. In the same table with the six-place logarithmic functions are given the natural functions to five places. A table of addition-subtraction logarithms is given, also one of natural logarithms. These are both very convenient tables, which are not usually found in books of tables for the engineer's desk. A table of prime and composite numbers gives the prime factors of all composite numbers, and the logarithms of prime numbers to ten places. The prime numbers are thus easily located. The usual tables of squares, cubes, square and cube roots, have the addition of a table of quarter squares. A very full table of the mathematical constants of the various sciences and arts, tables of Bessel's and of Binomial Coefficients and of errors of observation are convenient for many computers.

For so small a book Prof. Jones has made a very happy selection, and has ingeniously made it possible for an intelligent computer to make use of some things not directly emphasized. The writer has found a table of four-place logarithms so convenient that he suggests that two pages devoted to such a table would be a valuable addition. The type is clear and the paper is excellent, white and dull finish. The eighth edition is just issued, showing the popularity of the book and making it probable that there are no errors in it.

Gas Engine Hand Book, by E. W. Roberts, M. E. Published by the Gas Engine Publishing company, Cincinnati, O.

The author has undertaken to supply a manual for the gas engine field similar to works on the subject of the steam engine. Rules and formulae for the designing of gas engines are general and do not relate to the engines of special manufacturers. Much of this matter is new. The book will be helpful not only to the designer, but to the engineer in charge of operation. The value of it in this respect is indicated somewhat by some of the chapter headings, such as gas engine values, starting and stopping, care of engines, gas engine troubles, how gasoline engines differ from gas engines, igniters, valve mechanisms, governors, gas engine dynamos, testing, selection, heat values of various gases, etc. The book comprises 214 pages, and is of pocket size.

Proceedings of the Thirty-third Annual Convention of the American Institute of Architects. Glenn Brown, Editor.

This is a complete report comprising 240 pages, and contains many valuable papers freely illustrated.

Proceedings of the Second Annual Convention of the League of Iowa Municipalities. F. G. Pierce, Secretary, Marshalltown, Ia.

This report embraces a number of valuable papers read at the meeting of the League of Iowa Municipalities. Among

these are "Municipal Ownership A Corollary of Democracy," by George A. Gates, president Iowa College; "A Review of the Work of the Ohio Municipal Code Commission," by Edward Kibler, of Columbus, O.; "A Report on Municipal Bookkeeping," by H. F. Brown.

A Special Report of the Provincial Instructor on Public Highways, Dominion of Canada.

The report states that the agitation in favor of good roads carried on by the government of Canada during the last few years has not only advanced public opinion in favor of good roads, but has revealed to the general public that the system under which roads are at present made and maintained has not been conducive to the best results. It is expected that the result will be to increase the expenditure on roads. The importance of the matter is indicated by the statement that during ten years prior to 1897 the expenditures in Canada on roads, streets and bridges amounted to $30,623,958, not including statute labor, the money value of which is estimated at $41,000,000. The chief causes of trouble in present methods are that the control is so scattered that no one can be held responsible for a proper expenditure of the labor and money devoted to roads and the payment of taxes in labor is too vague and clumsy to meet modern conditions. These defects have been made so apparent that many of the Canadian townships have abolished statute labor and there is a growing feeling that a law prohibiting it should be passed by the provincial legislature. The instructor argues for a provision for road construction that will not place the burden of expense entirely on the farmer, which he believes to be inequitable, and will necessarily delay improvement of this kind. He thinks that there is sufficient benefit derived from good roads by towns to justify some proportion of the expense being placed upon them. He suggests a county system under which a portion of the cost of road building should be levied against towns and villages. An advantage of this plan he believes would also be better uniformity of work.

The Transmission of Typhoid by Sewage Polluted Oysters. By Kenneth Allen, C. E., Baltimore, Md.

This is a reprint of the paper read by Mr. Allen before the American Public Health Association at its last meeting. It makes a very strong showing on the danger side of the subject.

Syllabus of Lectures on Roads and Pavements, by Daniel B. Luten, Instructor in Civil Engineering, Purdue University, Lafayette, Ind.

These lectures were delivered before the civil engineering students of Purdue University. The syllabus covers the subjects of road economics, good roads movements, economics of road location, road construction, macadam, gravel, earth and steel roads, systems of maintenance, remedy for bad roads, pavement economics, street construction, stone block, brick, sheet asphalt, asphalt block and creosote wood block pavements, systems of maintenance and cleaning, street railways, street surveys, sidewalks and cycle paths. The pamphlet contains a condensation of much valuable information on these subject.

Personal Notes.

C. L. Granger, ex-mayor of Ft. Dodge, Ia., died recently.

L. F. Prevost has been re-elected city engineer at Lima, O.

Randolph Mason has been elected city engineer at Carbondale, Pa.

Hon. James M. Seymour has been re-elected mayor at Newark, N. J.

S. L. Etnyre has been re-elected city engineer at Council Bluffs, Ia.

Hon. George R. Perry has been re-elected mayor of Grand Rapids, Mich.

R. A. McClanathan has been appointed city engineer at Niagara Falls, N. Y.

William H. Rosecrans has resigned his position as city engineer at South Bend, Ind.

Richard W. Clark has been appointed Commissioner of public works at Tacoma, Wash.

Oliver Snaverly was elected president of the water board at East Syracuse, N. Y., April 3.

Joseph P. Phillips was re-elected city engineer April 9, at Scranton, Pa., for a term of three years.

John M. Farley has been appointed engineer in charge of the new reservoir at White Plains, N. Y.

John T. Barker and James Carroll have been elected members of the board of aldermen at Evanston, Ill.

C. K. Buck and W. F. Calkins have been elected members of the board of public works at Traverse City, Mich.

Patrick J. Condon, street superintendent at Jersey City, N. J., died of heart disease, April 2, aged sixty years.

Walter S. Ryan has been appointed village clerk and Clarence Carskadden street commissioner, at Oneida, N. Y.

G. L. Edmonston has been appointed city bridge engineer to succeed A. W. Munstee, resigned, at Minneapolis, Minn.

George D. Jenkins, formerly borough engineer at Washington, Pa., has been elected city engineer at Waynesburg, Pa.

C. F. Kerch has resigned his position as city engineer at Dixon, Ill., and accepted the same position at Janesville, Wis.

W. S. Brown has been appointed first mechanical engineer of the construction department of the St. Louis water works.

Thomas Martin has been appointed superintendent of the water department, to succeed John M. Hatch, at Pittsfield, Mass.

E. C. Dunn has resigned his position as city engineer of Alexandria, Va., to accept a government position at Columbus, Ga.

Irving T. Farnham has been elected city engineer at Newton, Mass., to succeed Henry D. Woods, who resigned the office some time ago.

W. F. Van Buskirk has resigned his position as city engineer of Stratford, Ont., and accepted that of city engineer of Rossland, B. C.

Van Alen Harris has resigned his position as city engineer of Middletown, N. Y. to join the government engineering staff in Porto Rico.

William T. Hunt, chairman of the New Jersey State Sewerage Commission, has sailed for Europe where he will study methods of sewage disposal.

Anthony Heib died at his home in Corry, Pa., April 13. Mr. Heib was one of the contractors who erected the old suspension bridge at Niagara Falls, N. Y.

Adna Dobson has been elected city engineer at Lincoln, Neb., to succeed Ferdinand Bonstedt, who resigned to accept a position on street work in Havana, Cuba.

Maj. J. W. Howard, C. E., of the staff of Municipal Engineering, is in Paris, where he will remain during the exposition and will serve as one of the jurors on awards.

J. C. Meem, M. Am. Soc. C. E., has been transferred from the sewer department in Brooklyn, to the sewer division of the Rapid Transit Commission of New York City as assistant engineer.

Charles F. Brush, Cleveland, O., has been awarded the Rumford medal of the American Academy of Arts and Sciences for his work in the development of the arc lamp, dynamo and lighting systems.

Dabney H. Maury, M. Am. Soc. M. E., engineer and superintendent of the Peoria Water Works company, Peoria, Ill., will establish an office as consulting engineer in addition to his present work.

Prof. William H. Burr has been awarded the first prize for a memorial bridge across the Potomac at Washington, William R. Hutton the second, L. L. Buck the third and George S. Morrison the fourth.

Samuel Tobias Wagner, M. Am. Soc. C. E., of the bureau of surveys, public works department, Philadelphia, has been appointed first assistant engineer in charge of the improvement, extension and filtration of the water supply, under Chief Engineer George S. Webster.

George W. Bramhall, South Orange, N. J., has resigned as a member of the Essex County Park Commission. His unexpired term will be filled out by Wm. A. Brewer, jr., of South Orange. Mr. Bramhal's resignation is due to pressure of private business. His services on the commission were highly valued, owing to his knowledge in matters of landscape engineering.

City engineers have been elected or appointed as follows: W. P. Mason, Marietta, O.; Irving T. Farnham, Newton, Mass.; Stephen J. Bussell, Oldtown, Me.; Edward F. Berry, Augusta, Me.; A. Gould White, Wellsville, O.; H. I. Reed, Colorado Springs, Col.; E. E. Miller, Cripple Creek, Col.; Andrew Rosewater, Omaha, Neb.; S. B. Remson, Creede, Neb.; F. V. Bodfish, Victor, Col.; L. C. Hall, Canon City, Col.; James E. Maxwell, Boulder, Col.; C. H. Knickerbocker, Trinidad, Col.; John Harper, Durango, Col.; R. F. Walter, Greeley, Col.; George D. Snyder, Williamsport, Pa.; James C. Brown, Bloomsburg, Pa.; Frank Hallam, McKeesport, Pa.; A. T. Randolph, Huntsville, Tex.; R. L. McWillis, Denison, Tex.; August Bohne, Kewanee, Wis.; John B. Bey, Waukesha, Wis.; Alexis H. French, Brookline, Mass.; O. C. Breed, Fulton, N. Y.; Harold Parsons, Stamford, Conn.; Alexander N. Murdock, Reading, Pa.; Charles J. Smith, Middletown, N. J.; Charles J. McGurg, New Bedford, Cann.; Archie P. Smith, North Tonawanda, N. Y.; William F. Williams, New Bedford, Mass.; E. F. Lewis, La Junta, Col., reappointed; Samuel A. Rank, Central City, Col., reappointed; R. S. Wilson, Globinville, Col.; W. H. Tromber, Glenwood Springs, Col.; Joseph P. Phillips, Scranton, Pa.; M. B. Cowden, Harrisburg, Pa.; N. G. Duvall, Braddock, Pa.; B. E. Briggs, Erie, Pa.; William Jackson, Boston, Mass.; L. M. Hastings, Cambridge, Mass.; Frederick Leach, Elmira, N. Y.; A. P. Smith, Lockport, N. Y.; J. Ross Robinson, Keokuk, Ia.; I. Austin Miller, Houston, Tex.; Edward W. Groves, Ann Arbor, Mich.; Norton L. Taylor, Tacoma, Wash.; P. H. Connolly, Racine, Wis.

MACHINERY AND TRADE.

Etheridge's Trap For Pumping Wells.

Mr. H. Etheridge, of McKeesport, Pa., has been granted patents on new and useful improvements in traps for pumping wells. The invention has for its object the provision of a new and novel means whereby sand deposits within water or other wells may be trapped and separated from the water, thus allowing a pure and constant supply to the pump. In deep wells where cylindrical strainers are employed the sand deposits gradually work into the openings or perforations of the strainer where they become lodged, preventing a full supply of water and finally requiring the strainer to be withdrawn, cleaned and replaced. Mr. Etheridge's object, therefore, is to provide a device in which these disadvantages are overcome. This he has accomplished in a way quite as simple as ingenious. The device has been put in successful operation in ten wells of the McKeesport water works system, where a very high velocity of water is obtained through the strainers without disturbing the sand, and consequently their use prevents the destruction of the valves and packing of pumps. In a report on the operation of the strainers to the board of water and light commissioners of McKeesport, Mr. J. M. Kinkaid, chief engineer, says: "It is very desirablee that the sand should be retained in the ground as a support to the heavy body of earth and pipes, and it is my belief, from tests made, that we could increase our output of water if all or nearly all of our wells were equipped with these strainers. I am of the opinion that we could lift our water from a greater depth than at present, for as the wells are now equipped with the open pipe we are confined to limited suction lift in consequence of pumping sand, although the evidence submitted shows that there is at least 19 feet of water below the bottom of the suction lines, and consequently we are limited in our water supply. I feel that after the thorough tests which have been made with this machine that we would be greatly benefited by equipping our wells with it, and thus avoid the trouble and damage from the sand coming out of the earth in the future."

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

No. 644,966. March 6, 1900. Garbage Furnace. S. H. Brown, Washington, D. C., assignor, two-thirds, to Michael McBarron,

Boston, Mass., and W. V. McGrath, Jr., Philadelphia, Pa. The liquids from the garbage are separated therefrom by gravity after being introduced in the furnace portion of the heat which is directed over and under the solid portions and over and under the liquids.

No. 645,000. March 6, 1900. Apparatus for fixing the pile in foreshore, J. L. Norris, Washington, D. C., administrator, assignor to Eleanor M. L. Case.

No. 645,146. March 12, 1900. Culvert, M. C. Trumbull, Savona, N. Y. A specific arrangement of flat and angle irons.

No. 645,160. March 13, 1900. Apparatus for Applying Sewage to Filter Beds. F. A. Barbour, Brockton, Mass., assignor one-half to F. H. Snow, same place. The raw sewage is introduced into a distributing tank from which lead independent passages to several filter beds. A single gate controls the several beds and is automatically controlled by the rise and fall of the liquid in the tank so as to open the passages one at a time, the others remaining closed.

No. 645,175. March 13, 1900. Excavating Machine, J. H. W. Libbe, Toledo, O. A machine mounted upon tracks and provided with a dredger arm. The machine is particularly designed for sewer excavations.

No. 645,414. March 13, 1900. Hand Street Sweeper, F. D. Wright, Syracuse, N. Y. A small hand machine carried upon a pair of wheels and having a rotary brush at its forward end.

No. 645,689. March 20, 1900. Drawbridge, Albert Lucuis, New York, N. Y. An ingenious vertically elastic turn-table or pivot for swing bridges.

No. 645,751. March 20, 1900. Apparatus for Purifying Sewers, Jared E. Lewis, Philadelphia, Pa. A tilting reservoir is provided which, when it has become filled, automatically discharges the water therein into a sewer so as to flush the same.

No. 645,916. March 20, 1900. Snow Melting Machine, Charles P. Gentler and C. J. Power, Matteawan, N. Y., assignors of two-thirds to John L. Hall, same place. A cart having an adjustable burner platform by means of which snow on the streets may be melted.

No. 645,991. March 27, 1900. Drawbridge Gate, Henry W. Yerrington, Oceanic, N. J.

No. 646,010. March 27, 1900. Bag-carrying Cart, Jay B. Rhodes, Harvey, Ill. Assignor to Frederick C. Austin, Chicago, Ill. A small hand cart for carrying bags for the use of street sweepers.

Trade Publications.

Illustrated Catalogue of Machinery and Tools for Asphalt Pavements.—This is issued by the Iroquois Iron Works of Buffalo, N. Y., and describes the machinery and tools manufactured by them, embracing sand heaters, bins, lifters and screens, steam melting tanks, pneumatic asphalt lift, asphalt cement bucket and binder mixers, street tools, road rollers and portable asphalt railway plants.

Coal Washing Equipments.—This is a catalogue of ninety pages, very freely illustrated, describing coal washing machinery made by the Jeffrey Manufacturing company of Columbus, in addition to which it contains also illustrations and descriptions of the conveying and elevating machinery of this firm.

Barrow and Truck Catalogue.—This gives illustrations, descriptions, price-lists of wheelbarrows, contractors' plows, steel sewer buckets, scrapers, push carts, trucks, etc., manufactured by the Syracuse Chilled Plow woks, Syracuse, N. Y. It is particularly desirable to contractors to have it at hand.

Trade Notes.

CEMENT.

Engineers have been engaged to prepare plans for the proposed new cement plant of the Newaygo Portland Cement Co., Newaygo, Mich.

The Knickerbocker Cement Co. has been formed for the purpose of making cement out of slag from the Poukhkeepsie Iron Works. E. K. Wales is president and A. C. Tower is treasurer of the new company. About $25,000 worth of machinery will be installed.

The cement works at Colorado Springs, Col., have opened a new ledge of cement bearing rock.

A new company has been organized to maufacture cement from the marl land of Petobago lake, Elk Rapids, Mich.

The Pennsylvania Cement Co., Bath, Pa., has been incorporated.

The Carolina Portland Cement Co., Charleston, S. C., has been incorporated by Peyre G. Hanahan, J. Ross Hanahan and Geo. H. Moffet.

The Alsen Cement Co. of Hamburg, Germany, has purchased through Dr. J. A. Bachman 110 acres of land at Friedensthal, Pa., and a large cement plant will be built this summer. The company has also purchased 300 acres of land at Smith's Landing near Catskill, N. Y., and a plant will be erected at once.

A rich deposit of marl covering an area of from 75 to 100 acres has been discovered near Brookfield, Madison Co., N. Y. A Michigan syndicate is reported as having agreed to put in a plant for the manufacture of cement.

The establishment of a Portland cement plant at Milltown, near New Albany, Ind., to make cement from oolitic limestone, is contemplated.

The Dexter Portland Cement Co., near Nazareth, Pa., has awarded the contract for the iron work of its new building to the Keysone Construction Co. of Easton, Pa., for about $40,000. More buildings will be erected at a cost of $180,000.

The Portland cement plant of the Brier Hill Iron & Coal Co., Youngstown, O., is being remodeled and its capacity increased.

New York and Chicago capitalists will establish a cement plant on the McDaniel and Daggy farm, near Bedford, Ind., according to press reports.

Plans and specifications are being made by the Osborne company, Cleveland, O., for

a new cement plant for the Austin Portland Cement company, to be located at Austin, Tex. As soon as the specifications are completed equipment contracts will be awarded.

The Deteroit Portland Cement company, Fenton, Mich., has been incorporated.

The Portland Cement company, Craigsville, Md., has completed its new buildings.

The Helderberg Cement company of Albany, N. Y., has increased its capital stock from $300,000 to $600,000.

A plant is to be erected near Bristol, Ind., at a cost of $1,000,000 for the manufacture of Portland cement. James S. Clarkson, formerly postmaster-general, is president of the corporation.

WATER WORKS.

Contracts have been awarded to William B. Scaife & Sons, Pittsburg, Pa., for the new buildings for the Iroquois Iron company of South Chicago, Ill. A large tonnage of structural steel is involved; also steel tanks and storage bins.

The United States government has just placed an order with the New York Filter Manufacturing company, 26 Cortlandt street, New York, for a large filter plant to furnish filtered water for the experimental model basin in the navy yard, Washington, D C

The O. H. Jewell Filter company, Chicago, Ill., has been awarded the second order for this year by the Terre Haute Water company of Terre Haute, Ind., for increasing the filter plant already installed in their works. This increased order is for filters of a capacity of 4,500,000 gallons in twenty-four hours, the original filter plant being of 4,000,000 gallons in twenty-four hours. The filters are of the horizontal pressure type.

Newly incorporated water companies: Richmond Park Water, Light, Land and Power company, Richmond, N. Y.; Montgomery and Bucks Counties Water company, Philadelphia; New Albany Light and Water company, New Albany, Ind.; Reynshanhurst Water company, Carbondale, Pa.; Nealton Water company, Kittanning, Pa.; Charles Offer Water Works, San Francisco, Cal.; Pittsburg Water Purifier and Boiler company, Pittsburg, Pa.; Citizens' Water company of Ocean City, Ocean City, N. J.; Citizens' Water company, Hempstead, Tex.; Rancheria Water company, San Bernardino, Cal.; John T. Carpenter Water company, El Modena, Cal.; Nome Water company, San Francisco, Cal.; Iomosa Water company, North Ontario, Cal.; Corn Hill Water Works company, Corn Hill, N. Y.

SEWER PIPE.

The Lookout Sewer Pipe works, Blowing Springs, Ga., will begin operations about May 1.

The sewer pipe manufacturers of Akron, O., are reported as contemplating the establishment of branch industries in Mexico.

The city council of Minneapolis, Minn., has awarded the contract for sewer pipe to the Union Sewer Pipe company, for $22,284.87.

The South Zanesville Brick and Sewer Pipe company, South Zanesville, O., will establish a sewer pipe plant at the works.

The Lock Haven Clay works, Lock Haven, Pa., have been leased by L. M. Patterson, of the firm of L. M. Patterson & Co., and will be extensively repaired and fitted for the manufacture of sewer pipe. The lease is for eight years.

MACHINERY.

The purchase of street sweepers is contemplated at Sandusky, O. I. W. Miller, Cy. Engr.

The city of Clinton, Ia., will probably purchase a stone crusher. Chas. P. Chase, Cy. Engr.

The city of Plainfield, N. J., may need some street sprinklers soon. Andrew J. Gavett, Cy. Engr.

The city council of Winona, Minn., has ordered the purchase of three new sprinkling wagons for the increased sprinkling districts.

The committee on supplies and repairs, Grand Rapids, Mich., was authorized April 6 to purchase a new road roller for $2,100.

The board of county freeholders, Newark, N. J., authorized the roads and assessment committee, April 12, to purchase a 12-ton roller not to exceed $3,250 in cost.

BRICK.

F. H. Eggers, Cleveland, O., will build a paving and fire-brick plant at South Brooklyn, a suburb of Cleveland.

A plant has been established at Altoona, Pa., for making vitrified shale brick, which will soon be in working order. J. B. De Haven is manager.

The Weston Brick company, Weston, Ore., was awarded the contract for furnishing 250,000 sewer brick to the city of Walla Walla, Wash.

A vitrified brick and tile factory is contemplated at Jasper, Tex. C. H. Carmichael and J. E. Parkhurst of Winnsboro, Tex., are interested.

A company is being organized to establish a large paving brick plant at Leloup, Kan. C. K. Sherman, Kansas City, Mo., and a number of capitalists of St. Joseph, Mo., are interested.

The National Supply company, 1014 Witherspoon Building, Philadelphia, Pa., has been organized to act as general agents for paving brick, cement and sewer pipe manufacturers. President, Harry M. Dixey; secretary and treasurer, Edgar F. Ellis.

The Gurnsey Brick and Construction company, Cambridge, O., manufacturers of paving and building brick, are reported as having in contemplation the purchase of two new double die repress machines and are desirous of receiving catalogues, etc., from manufacturers.

ELECTRIC LIGHT COMPANIES.

The Siemans & Halske Electric company of America, Chicago, has been purchased by the General Electric company of New York City. The Siemans & Halske company was organized in 1895 and owns an extensive plant, covering thirty acres.

The Consumers Carbon company, Lancaster, O., has been organized to manufacture carbons for electric lights and a number of novelties. The company has purchased fifteen acres of land east of the city and will begin the erection of buildings at once.

Newly incorporated companies: Spring Valley Gas and Electric company, Spring Valley, N. Y.; Knoxville Power company, Knoxville, Tenn.; Lea Electric Manufacturing company, Elwood, Ind.; Brunswick Gas company, Brunswick, Me.; City Lighting company, Pery, Ind.; Manchester Light, Heat and Power company, Manchester, N. Y.; Agamentiens Light and Power company, York, Me.

The Lea Manufacturing company, manufacturers of the Lea inclosed arc lamps, and the Robinson Electric Heater company, owners of the Robinson electric heating apparatus and rheostats, have been absorbed by the Lea Electric Manufacturing company of Elwood, Ind. The new company will increase its shop facilities so as to be able to keep up with the increasing demand for the Lea arc lamp. It will put on the market a line of heating devices, rheostats and special resistances of a very novel character and using a new resisting material. Mr. Mortimer Levering of LaFayette, Ind., is president; Jacob Loomis of Elwood is vice-president and general manager; Conway Robinson, formerly of Baltimore, Md., is assistant manager and engineer, and H. H. Thacker of Elwood is secretary.

MISCELLANEOUS.

The Troy Sewer company, Troy, N. J., has been incorporated to construct and operate a system of sewerage by G. W. Scott, G. T. Thomas, D. W. Wood, G. M. Clyde and C. T. Long.

The Chicago Star Construction company declared itself unable April 10 to carry out its contract with the city of Chicago in the construction of the Thirty-ninth-st. conduit of the intercepting sewerage system, and Judge Gibbons appointed Austin J. Doyle, jr., receiver. The company is declared insolvent and about to discontinue business. The total liabilities of the firm are placed at $250,000 to $300,000, of which amount $100,000 is due material dealers for supplies, nearly $15,000 for salaries to workmen and the remainder represents sums which are due on loans made to the concern by banks and individuals. The assets consist of less than $100,000, reserve funds held by the city and the machinery owned by the city.

The stockholders of the Joseph Dixon Crucible company, Jersey City, N. J., held their annual meeting April 16, re-electing the old board of directors as follows: Edward F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Alexander T. McGill and Joseph D. Bedle. The directors elected officers as follows: President, Edward F. C. Young; vice-president and treasurer, John A. Walker; secretary, George E. Long; counsel, Joseph D. Bedle.

The George H. Hitchcock Granite company, East Orange, N. J., has been incorporated to do a general quarrying business. The incorporators are George C. Chaney, Frederick Read and W. E. Hingston.

The Merchants' association of Fresno, Cal., is considering the construction of a boat canal from Fresno to the San Joaquin river, a distance of 125 miles, and would like to get prices on dredging and cost of constructing wooden locks. Louis Manuel, cy. engr.

A bill has been passed by the New York legislature appropriating $15,000 for the establishment and maintenance of a state school of clay working and ceramics at Alfred university.

The Maryland Sanitary, Refrigerating, Ventilating and Heating company has made application for incorporation under the laws of Maryland. The incorporators are Chas. H. Basshor, David M. Newbold, W. W. Varney, Chas. G. Diedman, Harrison Cassard and Oscar L. Quinlan of Baltimore. The corporation is to conduct a business of manufacturing, supplying and controling for the distribution, delivery and use of refrigerating, heating and ventilating agencies from a central point.

The Delaware Electric Light and Power company has secured a franchise at Delaware, O., to construct a hot water system of heating to be utilized in any locality.

A plant is being built at River Falls, Wis., by Ulrich & Anderson for the manufacture of sidewalk tiling.

The Colorado Roofing & Paving company, Denver, Col., has been incorporated, to conduct a roofing and paving business. The incorporators are G. T. Turner, J. Schmidt and H. Miller, all of Denver.

The large block of buildings comprising the stores of Boggs & Buhl, Allegheny, Pa., have recently installed a Scaife water filter with a capacity of over 125,000 gallons per day. Pure clear water is thereby furnished for the steam boilers, laundry purposes, as well as for drinking purposes and general use. No chemicals or coagulants of any kind are used in these filters, which are manufactured by William B. Scaife & Sons, Pittsburg, Pa.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Wabash, Ind.—All new work by the asphalt and brick contractors in this city is held up, pending a supreme court decisn on the Barrett street improvement law.

New Orleans, La.—Application was made to the Civil District Court, April 18, by George Rederscheimer for an injunction directed to restrain Mayor Flower from signing the contract with H. C. Spinks for paving St. Charles-st., alleging that Contractor Spinks did not submit the lowest bid

Elkhart, Ind.—Suit has been filed by George T. Murdock, a property-owner, to enjoin the city from paying for $60,000 worth of asphalt paving which was completed last fall by the Central Bermudez Asphalt company, alleging that the company and others pooled bids and that specifications were not observed.

Crawfordsville, Ind.—Public improvements in this city have been blocked by the recent decision of Judge Baker. Ordinances had been passed for several miles of brick paving, but when the city council met to open bids there was but one filed, and that was 40 per cent. higher than the estimates of the city engineer. The plans had been inspected by twelve contractors previous to Judge Baker's ruling. The bid which was received was rejected and action postponed.

CONTEMPLATED WORK.

Galesburg, Ill.—Paving is contemplated for Willard-st.

Akron, O.—Paving is recommended for Mill, Canal and Liberty-sts.

Morris, Ill.—Petitions have been circulated for paving Liberty-st.

Winona, Minn.—Plans will be prepared for paving Lafayette and Johnson-sts.

Austin, Minn.—The paving of Main-st. with brick is contemplated.

Rome, N. Y.—Plans for street paving are on file in the city engineer's office.

Batavia, Ill.—Brick paving is contemplated for Wilson-st. this summer.

Syracuse, N. Y.—A number of streets will be paved this year with brick.

Asheville, N. C.—The residents on Grove-st. have petitioned for brick paving.

Council Bluffs, Ia.—About three miles of paving is contemplated. Brick is favored.

Evanston, Ill.—An ordinance has been passed to pave Ridge-ave. Mayor Bates.

Champaign, Ill.—Paving is proposed for W. Park-st., from Neil to State. Mayor Sabin.

Atlanta, Ga.—A new resolution has been introduced providing for asphalt paving on Peters-st.

Lowell, Mass.—The street committee has voted to expend $59,600 for street asphalt paving.

Anderson, Ind.—A petition has been submitted to the council asking that Madison-ave. be paved.

Addyston, O.—The question of issuing bonds for street improvements will be voted on May 8.

Napa, Cal.—A resolution of intention to pave First-st. has been passed. H. H. Thompson, clk.

Carnegie, Pa.—About 5,000 sq. yds. of brick paving is contemplated. J. D. Ringwood, cy. engr.

Fremont, O.—The property-owners on E.

State and Croghan-sts. have petitioned for fire brick paving.

Hartford, Conn.—The street board has authorized the paving of Albany-ave. and Lewis and Spruce-sts.

Kansas City, Mo.—A resoution has been adopted to pave Holly-st. with asphalt. C. S. Curry, clk.

Bangor, Me.—(Special)—Main-st. will be paved with stone on sand foundation. Frank L. Marston, cy. engr.

Shelby, O.—The property-owners on Broadway-st. have petitioned for brick or asphalt paving.

St. Joseph, Mo.—An ordinance has been passed to pave Cherokee-st. in South St. Joseph with asphalt.

New Kensington, Pa.—The question of issuing bonds for street paving and sewers will be voted on May 5.

South Omaha, Neb.—The property-owners on O-st. are circulating a petition for vitrified brick paving.

Linton, Ind.—This town voted April 17 in favor of incorporation, street improvements and water works.

New Haven, Conn.—An appropriation of $30,000 for paving Church-st. with brick has been favorably voted on.

Windsor, Canada—The board of works decided, April 12, to advertise for bids for 30,000 feet of sidewalk.

Hornellsville, N. Y.—F. W. Dalrymple, cy. engr., says 5,000 sq. yds. of brick paving on concrete is contemplated.

St. Louis, Mo.—Ordinances have been approved for paving Eastern-ave. with brick and Sixteenth-st. with granite.

Painesville, O.—A resolution has been passed to pave St. Clair and Liberty-sts. and the streets around the park.

Vailsburg, N. J.—Ordinances are pending for telford paving on Sanford, Halstead and Wall-sts. and Orange-ave.

Rockford, Ill.—The property owners on Seventh-st. are considering the relative merits of brick and asphalt paving.

Taunton, Mass.—An appropriation for $15,000 for block paving and macadamizing is pending. George A. King, cy. engr.

Alton, Ill.—Bids will be asked soon for paving Union-st. with brick or macadam foundation. A. E. Rutledge, cy. engr.

Macon, Ga.—Wall-st. and Washington-ave. will be paved with brick on 6 inch concrete foundation. J. W. Wilcox, cy. engr.

Jackson, Mich.—This city will expend $4,000 or more on macadamizing various streets. R. M. Newman, cy. engr.

Somerville, N. J.—Bids will be received in October for building about 9 miles of macadam county roads. J. Doughty, jr., co. engr.

Tarentum, Pa.—This city will construct about 6,750 sq. yds. of brick and 4,500 sq. yds. of block stone paving. F. A. Ready, Boro. sec'y.

Moline, Ill.—A petition asking that Seventeenth-st., from Fourth to Eighth-ave., be paved with asphalt, has been submitted to the mayor.

Beaver Falls, Pa.—The construction of 12,000 sq. yds. brick paving on gravel foundation is contemplated. Harry T. Barker, cy. engr.

Sioux City, Ia.—The property owners on Douglas and Pierce-sts. are circulating petitions asking for the paving of three streets.

Denver, Col.—Plans have been adopted for 63,000 ft. of 5x8 in. curb set in cement in Capitol Hill grading and curbing district No. 2.

Mankato, Minn.—Council has voted that sidewalks on Pleasant-st., from Byron to Willard, shall hereafter be paved with stone, cement or brick.

Kansas City, Mo.—Vine, Eighth, Washington and other streets will be paved with asphalt and certain alleys with brick. H. A. Wise, cy. engr.

Grand Island, Neb.—(Special)—Bids are desired for concrete, flagstone and brick sidewalks, and concrete and stone curbing. Arnold C. Koenig, cy. engr.

Ann Arbor, Mich.—The construction of 11,168 sq. yds. of brick paving on concrete, on Huron-st., is contemplated. The contract has not yet been let.

Port Chester, N. Y.—The village trustees have authorized the extension of the paving in Westchester-ave. Asphalt or Belgian block will probably be used.

North Adams, Mass.—(Special)—John H. Emigh, cy. engr., says that probably some brick paving will be laid, but the location and quantity has not been decided upon.

Alton, Ill.—The C., P. & St. L. R. R. company has requested the city council to pass an ordinance for paving around the new freight depot with vitrified brick.

La Crosse, Wis.—Bids will be received about July 1 for 65,000 sq. yds. of brick paving on concrete on the business streets. Frank Powell, cy. engr.

Glens Falls, N. Y.—Asphalt paving on concrete and brick paving on brick foundation are contemplated. The time for receiving bids has not been fixed. George P. Slade, cy. engr.

Nashua, N. H.—About 3,200 sq. yds. of stone paving is contemplated, but the streets upon which it will be laid have not been decided upon yet. A. W. Dean, cy. engr.

Columbus, Ga.—About 5,000 sq. yds. of brick paving on 6 in. concrete will be laid on Tenth-st., between Broad and First-ave. R. G. Johnson, Supt. Pub. Works.

Delta, O.—A resolution has been passed to pave Mill-st., from Main to Providence, with brick or block on a concrete foundation. N. E. Boller, mayor; F. W. Zerman, clk.

Nebraska City, Neb.—About 13,000 sq. yds. of brick paving on concrete is contemplated on Central-ave., between Eleventh and Sixteenth-sts. A. M. Munn, cy. engr.

Kalamazoo, Mich.—The city council has asked for estimates for brick paving on S. Portage, S. Burdick and N. Rose-sts. No bids will be asked for this work as it will be done by day labor.

Canton, O.—About 40,000 sq. yds. of brick paving on gravel foundation will be laid on Cherry, E. Seventh, Eighth, Ninth, W. Fourth, Lewis-ave. and other streets. Phil H. Weber, cy. engr.

Cumberland, Md.—About 15,400 sq. yds. of brick paving will be laid on Baltimore, Bidford and Decatur-sts. The time for receiving bids has not been decided upon. D. P. LeFevre, cy. engr.

Joliet Ill.—The construction of 20,000 sq. yds. of asphalt paving on 6-in. concrete, on Union-st., Third-ave. and Lincoln-st., and 4,200 sq. yds. of brick paving on Cass-st., is contemplated. H. A. Stevens, cy. engr.

Flint, Mich.—About 50,000 sq. yds. of brick paving on 6-in. concrete will be laid on Second and Kearsley-sts., and about 5,000 sq. yds. of cedar paving on 6-in. concrete on E. Kearsley-st. Albert N. D. Hall, cy engr.

Marinette, Wis.—Harry McCollum, Cy. Engr., says that 18,000 sq. yds. of brick paving on stone foundation, with 700 lin. ft. of stone curb, will be laid on Hall-ave. and Main-st. Definite action will be taken in May.

Duluth, Minn.—The board of public works has recommended that ten feet on each side of Central-ave., between Ramsey and Main-sts., be repaved with cedar blocks. The paving of several avenues with sandstone is also contemplated.

Rochester, N. Y.—The city engineer has been directed to prepare estimates for paving Ames-st. and Joseph-ave. with asphalt; Clinton-ave., N., with block; Main-st. with Medina block, North-st. and Joseph-ave. with block stone, and North-st. with asphalt.

Altoona, Pa.—(Special.)—Harvey Linton, Cy. Engr., says that about 4,000 sq. yds. of

vitrified brick paving may be laid on Sixteenth-st. this year, but that it has not been definitely decided upon. Paving will depend upon petition of abutting owners of property.

CONTRACTS TO BE LET.

Bond Hill, O.—Bids are asked until May 11 for repairing streets. A. J. Kiphart, vil. clk.

Stamford, Conn.—Bids are asked until May 1 for building a road. Edwin S. Holly, first selectman.

Rushford, Minn.—Bids will be received until May 5 for building a new road. Ole Gullickson, vil. rec.

Shandaken, N. Y.—Bids are asked until May 1 for improving over 5 mls. of turnpike. Edw. A. Bond, state engr., Albany, N. Y.

Dorr, Ill.—Bids will be received until May 1 for grading and graveling roads. Theo. Hamer, town clk.

Bristol, Va.—Bids are asked until May 12 for ten or twelve thousand sq. yds. of vitrified brick paving. St com.

Vevay, Ind.—Sealed bids are asked until May 7 for building free gravel and macadam roads. John F. Houze, co. audt.

Bradford, Pa.—Bids are asked until May 7 for brick paving on Bishop-st. and Congress-place. P. B. Windree, cy. engr.

Albany, N. Y.—Bids were asked until May 1 for improving about eighteen mls. of state roads. E. A. Bond, state engr.

Johnstown, N. Y.—Bids will be received about May 21 for about 4,200 sq. yds. of brick paving. Jas. Miller, cy. engr.

New Albany, Ind.—Sealed proposals will be received May 7 for asphalt paving on a portion of Main-st. Edward Crumbeo, mayor.

Paoli, Ind.—Sealed bids are asked until May 9 for building about twenty-seven mls. of macadam and gravel roads. G. W. Tegarden, co. audt.

Toledo, O.—Sealed proposals are asked until May 7 for paving Eastern-ave. with vitrified brick or blocks. Wm. O. Holst, cy. clk.

Sheldon, Ia.—Bids are asked until May 14 for curbing and guttering a portion of Ninth-st. and Third-ave. F. W. Walsmith, cy. clk.

Watertown, N. Y.—Bids will be received May 15 for 5,000 sq. yds. of asphalt paving on Court-st. C. O. McComb, cy. engr.

Lisbon, N. D.—Bids are asked until May 2 for 1,500 sq. yds. of stone cement sidewalk around the court house. Wm. M. Jones, co. audt.

Bowling Green, Ky.—Bids are asked until May 5 for furnishing macadam and gravel for the county roads. J. W. Gilbert, rd. supryr.

Chillicothe, O.—Sealed bids will be received May 10 for 16,000 sq. yds. of brick paving on concrete foundation. H. M. Redd, cy. engr.

Winnipeg, Man.—Sealed proposals are desired until May 2 for from 100 to 200 tons of asphalt for street paving. C. J. Brown, cy. clk.

Columbus, Ind.—Sealed bids are asked until May 7 for building 7 mls. and 3,349 ft. of free gravel roads in Ohio township. Thos. May, chmn. bd. co. comrs.

Janesville, Wis.—Sealed bids are asked until May 21 for paving S. Second and S. Jackson-sts. with macadam, with curbing and gutters C. V. Kerch, cy. engr.

Princeton, Ind.—Sealed bids are asked until May 11 for building 22 mls. and 3,457 ft. of gravel or macadam roads. Embree C. Farmer, chmn. co. comrs.

Decatur, Ind.—Bids are asked until May 24 for building macadam roads in Geneva, Ceylon and Wabash townships, and the Joll Hirchez macadam road. W. E. Fulk, engr.

Martinsville, Ind.—Sealed bids are asked until May 7 for macadamizing a road in Adams township. John S. Whitaker, co. audt. Geo. Pearcy, chmn. co. comrs.

Akron, O.—(Special.)—Sealed bids will be received until May 7 for 38,117 sq. yds. of asphalt paving on concrete and block asphalt on concrete on Market-st. J. W. Payne, cy. engr.

Troy, O.—Sealed bids are asked until May 1 for grading and graveling the street and sidewalk of Olive-st., from Madison to Garfiled-ave. P. J. Goodrich, cy. clk.

Springfield, O.—Sealed proposals are asked until May 14 for paving S. Center-st., from Washington to Mulberry, with vitrified paving brick or blocks. Philip Huonker, cy. clk.

St. Paul, Minn.—Bids are asked until May 7 for grading the Stillwater road, Minnehaha-st., part of Upper Afton road, and part of Ramsey and Washington county line road. W. R. Johnson, co. audt.

Spokane, Wash.—Sealed proposals will be received until May 4 for paving Sprague-ave., from Madison to Bernard, with asphalt on concrete, with granite curbing. Robt. E. Clarke, sec. B. P. W.

Owensboro, Ky.—(Special)—Sealed bids will be received until May 14 for building about 65 sq. yds. of macadam streets, and about 43,000 lin. ft. of combined cement curb and gutter. E. B. Shifley, cy. engr.

Evanston, O.—Bids are asked until May 4 for improving eight streets. Bids are asked until May 19 for improving Keeper-ave., from Montgomery boulevard to Langdon-ave. Wm. H. Krap, vil. clk.

Highland Park, Ill.—Sealed bids will be received until May 8 for grading, curbing and macadamizing the Sheridan road, from Central-ave. to Ft. Sheridan reservation, about 21,600 sq. yds. John Finney, cy. clk.

East Newark, N. J.—Sealed proposals are asked until May 9 for paving Third-st., from Sherman-ave. ot Central-ave., with brick or block on concrete and John-st., from the town of Harrison to Sherman-ave., with asphalt on concrete. Edward Kenny, mayor; Wm. Healey, boro. clk.

Georgetown, O.—The contract for improving the first and second sections of the Five Mile and Marathon road in Green, Sterling and Perry townships, will be sold at public outcry May 22 and the contract for improving the first and second sections of the Carlisle and Eagle Creek road in Jackson township will be sold May 23. Robt. McCall, co. audt

CONTRACTS AWARDED.

Rockford, Ill.—Contracts for macadamizing eight streets were awarded to John Rydbloom, April 7.

Pipestone, Minn.—The contract for curbing and guttering the main street has been awarded to Rae Bros.

Millburn, N. J.—The contract for laying flag walk was awarded to Elmer Sickley, of Springfifield, at 42 cts. a ft.

Waukesha, Wis.—The contract for paving Broadway with brick was awarded to August Dieman & Son, for $17,896.66.

Erie, Pa.—The Alcatraz Paving company, New York City, secured the contract for paving State-st. at $2 a sq. yd.: total, $16,000.

Kearney, N. J.—David Harper of Newark secured the contract for paving Midland-ave., from Kearney to Davis-aves., with granite block.

Butte, Mont.—The contract for paving N. Wyoming and S. Main-sts. with granite blocks has been awarded to Thos. Rowan, at $3.47 a sq. yd.

Huntington, L. I.—The contract for building a highway across Centerport harbor was awarded April 6 to George W. Brush, of Northport, for $3,198.

Moline, Ill.—The contract for paving three streets and two alleys with brick was awarded to the Tri-City Construction company of Davenport, for $24,626.

Chattanooga, Tenn.—The Barber Asphalt Paving company was awarded the contract for paving W. Eighth-st., between Board

and Chestnut, with asphalt at $2.19 a sq. yd.

Nashville, Tenn.—The contract for paving with granite the square at Broad and McNairy-sts. has been awarded to the Nashville Roofing and Paving company at $2.35 a sq. yd.

Syracuse, N. Y.—The contract for paving N. Clinton-st., from W. Willow-st. to Belden-ave., and Belden-ave., from Clinton to Fulton, was awarded to George A. Morris, for $9,748.10.

Milwaukee, Wis.—The Western Paving and Supply company has been awarded contracts for paving thriteen streets, at prices ranging from $2.10 to $2.23½ a sq. yd. and aggregating $89,000.

Hoopeston, Ill.—George Prutsman of Anderson, Ind., secured the contract for paving E. Main-st. with brick, at $1.97¾ a sq. yd.; 25 cents a foot for straight curbing, 50 cents for corner curbing.

Vincennes, Ind.—The contract for building 36 1-3 miles of macadam roads in Vigo township, and 27 miles in Widner township, was awarded to C. P. Bruce & Co., of Bicknell, at $66,207.60 and $47,454.11 respectively.

Columbus, Ga.—The contract for paving Tenth-st., from Broad to First-ave., and parts of First-ave., between Tenth and Eleventh, with brick, has been awarded to the Coaldale Paving Brick company, Coaldale, Ala., for $8,740.

East Hartford, Conn.—Bids were received April 5 for building new macadam roads on Burnside-ave., Silver and Brewer-sts., the average price being from $1.09 a lin. foot for Burnside-ave., $1.12 for Silver-st., and $1.17 for Brewer-st.

Denver, Col.—The Colorado Paving company submitted the lowest bid for paving Water-st. and W. Twenty-third-ave. at $44,782.60. The other bids were: R. P. McDonald Building company, $44,985.59; Wickham Bros., $48,762.75; J. M. O'Rourke Construction company, $48,782.65.

Amsterdam, N. Y.—Brick and asphalt paving contracts were awarded April 3, as follows: Brick, 6,000 sq. yds., Baker & Judson, Gloversville, N. Y., $2 a sq. yd., total, $12,314; asphalt, 6,000 sq. yds., Warren Scharf Asphalt Paving company, $2.79, total, $17,105.

Chicago, Ill.—Bids were received April 11 for street paving, the prices ranging from $1.95 for asphalt to $2.20 a sq. yd., $3.45 to $3.70 for granite block, and brick from $1.99 upward. The Bermudez Asphalt company submitted the lowest bid, $1.95 for asphalt.

Paterson, N. J.—Bids were received April 16 for paving nine streets with brick, the bids ranging from $2.10 to $2.35 a sq. yd. The awarding of the contract was deferred. The contract for trap rock paving on Straight-st. was awarded to McKiernan & Bergin, at $2.10 a sq. yd.

Allegheny, Pa.—The Northside Coal and Sand company was awarded the contract for grading, paving and curbing Duquesne-ave., with Ligonier block stone, at $2.03 a sq. yd.; exc., 46½ cts.; curb, 56 cts.; crossing, 65 cts.; brick sidewalk, 65 cts. a sq. yd.; flag sidewalk, 65 cts. a sq. ft.; masonry, $6.50 a cu. yd.

New Haven, Conn.—The contract for laying the brick paving on E. Chapel-st., from East to E. Pearl-st., was awarded to Rice & Turner of Rondout and Mt. Vernon, N. Y., at $1.02 a sq. yd. The Eastern Paving Brick company of Catskill, N. Y., secured the contract for furnishing 1,000,000 brick at $14.50 a thousand.

Cohoes, N. Y.—The Hastings Paving company and the Standard Asphalt company of New York City were the only bidders, April 11, for street paving, but their bids were returned.

Toledo, O.—The statement in the contracting news department of the April number of Municipal Engineering Magazine that the contract for paving Hicks-st. with granite blocks was awarded to H. G. Jennison for $24,711 was an error. The contract was awarded to C. W. McKinnney for $24,772.25, using Nelsonville block.

Bloomfield, Ind.—Bids were received April 6 for building macadam roads in Smith township, as follows: Slinkard & Masselon, Newberry, on all roads, $21,400; S. T. Hays, Worthington, road 2, $6,133; road 3, $5,942; road 4, $4,309; J. E. Jean, road 2, $6,000; road 3, $6,000; road 4, $4,250; all roads, $20,400; Geo. Notler, road 1, $4,220; road 3, $5,740; F. L. Jesup, road 1, $4,200.

Newark, N. J.—Bids were received April 12 for paving Washington-ave. with asphalt, as follows: Barber Asphalt Paving company, $2.18 a sq. yd.; Metropolitan Asphalt Paving company, $2.06; Atlantic Alcatraz Asphalt company, $2.15; New Jersey Asphalt company, $2.25. The bid of the Metropolitan Asphalt Paving company was the lowest on the whole as well as for the asphalt only, the total being $70,826. The awarding of the contract was laid over.

Chillicothe, O.—Bids were received April 10 for paving Paint, Mulberry and Water-sts. with brick, from the following contractors: Pfaff, Ringgold & Smith, Chillicothe, O., ranging from 65 to 86 cts. a sq. yd. for brick; Daniel E. Sullivan, Columbus, O., 78 to 98 cts.; A. G. Pugh, Columbus, O.; 75 to 96 cts.; Henry Gantz, Columbus, 72 to 92 cts.; Kelly Bros., Portsmouth, 77 to 97 cts.; Beaver Falls Paving company, Beaver Falls, Pa., 67 to 88 cts.

St. Paul, Minn.—The lowest bids received April 12 for street improvements were as follows: Sibley-st., asphalt, Barber Asphalt Paving company, $2,817; sewer connection, $35 each; paving alley in block 21, Woodlawn Park addition, brick, Fielding & Shepley, $1,950; grading and improving Van Buren-st., $1,196; and Colorado-st., $546, Thomas Finnan. Contracts have been awarded as follows: Broadway, brick, $12,692, and Waconta-st., $13,492, Fielding & Shepley; asphalt Farrington-st., $10,092; Sherburne-st., $3,952, and Summit-st., $6,916, Barber Asphalt Paving company; Waconta, from Seventh to Ninth and Ninth from Locust to Broadway, brick, James Forrestal company, $4,200 and $8,400 respectively.

Buffalo, N. Y.—The contract for paving Keystone-st. with brick has been awarded to George W. Partridge for $18,592. The lowest bids submitted for repaving E. Genesee-st., were those of the Barber Asphalt Paving company, at $45,239 for asphalt, and P. B. McNaughton, at $40,900 for brick. The lowest bids received April 18 for paving and repaving as follows; Repaving Emslie-st., H. P. Burgard, asphalt, $21,400; P. B. McNaughton, brick, $15,480; Goodell-st., H. P. Burgard, asphalt, $5,477; John Mumm, brick, $4,000; Indiana-st., Barber Asphalt company, $4,275; P. B. McNaughton, brick, $3,110; Washington, Barber Asphalt company, $6,881; P. B. McNaughton, brick, $5,080.

SEWERS.

Greensburg, Pa.—A sewer inclosing Coal Run, in this city, partially collapsed April 14, endangering the whole structure.

Walla Walla, Wash.—The Blalock Fruit company has signed a contract to take all the sewage wastes from this city for irrigation of its orchards.

Denver, Col.—The Sixteenth-st. auxiliary sewer has been completed. It was one of the most difficult and dangerous jobs of its kind ever undertaken in this city. M. J. Dowling was the contractor.

Tucson, Ariz.—(Special.)—Preliminary to the construction of a sewer system the water and sewerage commission has asked for bids from civil engineers, as shown by advertisement in Municipal Engineering, for designing plans and specifications for a complete sewer system. Data in reference to drainage, area, elevations, rainfall, method of water supply, etc., will be fur-

nished on request by Chas. McConnell, city recorder. Competitors will be required to furnish references with their bids as to their experience.

CONTRACTS TO BE LET.

Wabash, Ind.—Sealed bids are asked until May 14 for a sewer in Wabash-st. R. P. Woods, cy. engr.

Evanston, O.—Sealed bids will be received until May 4 for building sewers. William H. Krapp, clk.

Norwood, O.—Bids are asked until May 21 for 13,000 ft. of 15-8 in. pipe sewers. J. A. Stewart, vil. engr.

Chillicothe, O.—Sealed bids are asked until May 10 for 2,000 lin. ft. of 6-8 in. pipe sewer. H. M. Redd, cy. engr.

Cleveland, O.—Bids are asked until May 3 for building two sewers. John Vanderveide, deputy dir. pub. wks.

La Crosse, Wis.—Bids will be asked until May 4 for 650 lin. ft. 8 in. pipe sewer. S. Frank Powell, cy. engr.

Toledo, O.—Sealed bids will be received until May 7 for building pipe sewers in two streets. William O. Holst, cy. clk.

Springfield, O.—Sealed bids are asked until May 14 for an 18 in. pipe sewer in S. Centre-st. Philip Huonker, cy. clk.

Waterbury, Conn.—Bids are asked until May 1 for 3,450 ft. 15-8 in. pipe sewers and 14 manholes. R. A. Cairns, cy. engr.

Bond Hill, O.—Bids are asked until May 11 for a culvert at Ross run creek under Paddock road. A. J. Kiphart, vil. clk.

Butte, Mont.—Sealed bids will be received until May 7 for 4,500 ft. 8-10-12 in. pipe sewers. F. C. Bickenbach, cy engr.

Chicago, Ill.—Sealed bids are asked until May 1 for plumbing, sewerage, etc., at Central Park-ave. pumping station. L. E. McGann, coun. pub. wks.

Muncie, Ind.—Bids are asked until May 14 for building 42 to 24 in. brick and 24 to 8 in. pipe sewers in Kirby-ave. F. W. Clevenger, cy. clk.

Watertown, N. Y.—Sealed bids will be received until June 1 for 4,000 lin. ft. of 3½x3 and 5,000 ft. 5½x3 ft. brick sewer. C. O. McComb, cy. engr.

Norristown, Pa.—Sealed bids will be received until May 4 for building an 8 in. pipe sewer, with laterals, to house line, manholes, flush tanks, etc. S. Cameron Corson, boro. engr.

Worcester, Mass.—Bids are asked until May 15 for about 100,000 ft. of vitrified pipe with fittings; 12,000 bbls. of Portland cement; 3,000 bbls. Rosendale cement; such sewer brick as may be required during this year.

Altoona, Pa.—Sealed proposals are asked until May 4 for building 11,257 ft. of 8 in. pipe sewer, including 454 6 in. Y branches, 40-8 in. Y branches, and 14 ⅛ bends; 504 ft. 10 in. sewer pipe, including 19-6 in. Y branches and 4-8 in. Y branches; 305 ft. 12 in. sewer pipe, including 12-6 in. Y branches and 2-⅛ bends; 682 ft. 15 in. sewer pipe, including 23-6 in. Y branches, one 12 in. Y branch; 122 ft. 6 in. sewer pipe, with 16 ⅛ bends and 4 "breeches" Y's. Harvey Linton, cy. engr.

CONTEMPLATED WORK.

Iron River, Wis.—A sewer on Main-st. is proposed.

Morris, Ill.—Petitions are being circulated for sewers in Liberty-st.

Sterling, Ill.—The question of building sewers is being considered.

Carlisle, Pa.—Plans have been prepared for a sewerage system.

Lewiston, Me.—About one mile of pipe sewers will be built this year.

Lowell, Mass.—The council has voted to borrow $25,000 for building sewers.

Jamestown, N. Y.—This city has voted to issue bonds for extending the sewers.

Canton, O.—About 2 miles of 8-inch pipe sewer will be built. Phil H. Weber, cy. engr.

Des Moines, Ia.—A sewerage system is contemplated for the State Fair grounds.

Aberdeen, Wash.—Plans for a sewerage system are invited by Geo. A. Black, cy. engr.

Alton, Ill.—About 2,400 ft. of 15 in. pipe sewers will be built. E. E. Rutledge, cy. engr.

New Orleans, La.—This city voted to issue $14,000,000 bonds for water, sewerage and drainage.

Huntington, L. I., N. Y.—A sewerage system and sewerage disposal plant is contemplated.

Framinghon, Mass.—This town has voted to build another main sewer; estimated cost, $30,000.

Pottstown, Pa.—A sewer ordinance is pending before the council. Ralph E. Shaw, boro. surv.

Bristol, Va.—The city engineer has been directed to prepare plans for a sewerage system.

Nashua, N. H.—Brick and pipe sewers are contemplated at a cost of $35,000. A. W. Dean, cy. egr.

Clinton, Mass.—This town has voted $5,000 for sewer extension. H. A. Thessell, cy. engr.

Scranton, Pa.—A sewer in N. Washington-ave., between New York and Marion-sts., is contemplated.

Binghamton, N. Y.—The bill appropriating $100,000 for sewers has been signed by the governor.

Whitestone, N. Y.—Resolutions have been adopted for building sewers in Nineteenth and Twentieth-sts.

St. Joseph, Mo.—The mayor has signed an ordinance for a sewerage system in South St. Joseph.

Adrian, Mich.—Plans for a sewerage system will be made by M. B. Haynes, C. E., of Mankato, Minn.

Sag Harbor, L. I.—The question of building a sewerge system is again being agitated.

Fair Haven, Mass.—About 4,000 ft. of 18-8 in. pipe sewers will be built. George A. Briggs, engr.

Wyoming, N. Y.—An engineer will be employed to survey and map this city for a sewerage system.

Swissvale, Pa.—Plans have been submitted for a sewerage system. Councilmen Little, McKim and Wolf.

Rockford, Ill.—The construction of 10,560 ft. of 9 to 20 in. pipe sewer is contemplated. Edwin Main, cy. engr.

Woonsocket, R. I.—About one and one-half mis. of pipe sewer will be built by day labor. Frank H. Mills, cy. engr.

Sherman, Tex.—A citizens' committee is raising a fund by private subscription for building a sewerage system.

Ashland, Wis.—A sewerage district has been formed and the board of public works will hear objections May 7.

Decatur, Ind.—The county commissioners contemplate building a sewerage system for the infirmary buildings.

Watkins, N. Y.—The bill authorizing this city to issue bonds for a sewerage system has been signed by the mayor.

Lagrange, Ga.—The question of issuing bonds for building sewers will be voted on in May. J. T. Johnson, cy. clk.

Green Bay, Wis.—Contracts will probably be let later in the season for some pipe sewer. A. L. Hillis, cy. engr.

Williamsport, Pa.—About 2,000 lin. ft. of brick sewer on Locust-st. is contemplated. Geo. D. Snyder, cy. engr.

Herkimer, N. Y.—The residents on Greene and Steuben-sts. have petitioned the board of village trustees for sewers.

Hornellsville, N. Y.—The construction of 1,560 ft. of 8-15 in. pipe sewer is contemplated. F. W. Dalrymple, cy. engr.

Batavia, N. Y.—The board of aldermen

has decided to submit the sewerage system question to a vote of the people.

Angola, Ind.—Plans for a sewerage system are being prepared by Geo. S. Pierson, M. Am. Soc. C. E., Kalamazoo, Mich.

Sea Isle City, N. J.—Plans for a new sewerage system have been approved by the New Jersey State Sewerage commission.

Niagara Falls, N. Y.—The construction of sewers in two streets is recommended by the board of public works. Mayor Butler.

North Tonawanda, N. Y.—Plans and estimates for sewers in the Ironton district have been prepared. W. Cooke Oills, mayor.

Nebraska City, Neb.—A 15 in. pipe sewer on Fourth-ave., east from Seventh-st., 2,200 feet, is contemplated. A. M. Munn, cy. engr.

Cedar Falls, Ia.—About 1,000 lin. ft. of 6 ft. brick sewer will be built on Park court, at a cost of $8,000. G. H. Meredith, cy. engr.

Pueblo, Col.—About 6 or 7 mis. of sewer laterals, principally 8 in., will be constructed during the year. Wm. Peach, cy. engr.

Joliet, Ill.—About 6,000 ft. of 12 in. pipe sewers will be built on Chicago, Summit, Collins and Ottawa-sts. H. A. Stevens, cy. engr.

Holland, Mich.—Plans for a sewerage system have been prepared by Alvord & Shields of Chicago. Jas. De Young, supt. pub. works.

Fitchburg, Mass.—A special committee will be appointed soon to investigate and report to the city council on sewerage disposal.

Merchantville, N. J.—Correspondence is invited from companies in regard to building a sewerage system. W. B. Stewart, boro clk.

The question of issuing sewer bonds has been favorably voted on at the following places: Madelia, Minn.; Rawlins, Wyo.; Pomona, Cal.

Clinton, Ia.—The Iowa Engineering company is preparing plans for a sewerage system and a sewage disposal plant. C. P. Chase, cy. engr.

Glens Falls, N. Y.—About 5,000 lineal feet of 10-24-30 inch pipe sewers will be built on Ridge and other streets. George P. Slade, cy engr.

Providence, R. I.—The advisability of building some sewers is being discussed, and one stone arch culvert will be built. J. A. Latham, town engr.

Clarence, N. Y.—The bill appropriating $45,000 for improving the drainage in the northern part of this town has been signed by the governor.

Columbus, Ga.—The construction of 150 ft. of 3½ ft. brick sewer on North-st., between Twenty-fourth and Twenty-fifth-sts. is contemplated. R. E. Johnson, supt. B. P. W.

Troy, O.—The Troy Sewer company has been incorporated to build a complete sewerage system by George W. Scott, D. W. Wood, G. T. Thomas, George M. Clyde and C. T. Long.

Rome City, Ind.—Plans for sewers and sewage disposal works are being prepared for Island Park resort by George S. Pierson, M. Am. Soc. C. E., Kalamazoo, Mich.

Middleboro, Mass.—James M. Coombs and W. A. Andrews have been appointed a committee to obtain information relating to various methods of sewage disposal.

Madison, N. J.—Plans for sewerage and sewage disposal have been made by Edmund K. Brown of Madison. The estimated cost, including the disposal works, is $50,000.

North Adams, Mass.—(Special)—It is probable that $20,000 or $25,000 will be expended in building tile sewers in various sizes, the city employing its own labor. John H. Emigh, cy. engr.

Manistee, Mich.—(Special)—About 1,840 ft. of 9 inch pipe sewer will be built on First, Fourth, Sixth and Taylor-sts., the city employing its own labor. E. W. Menscher, cy. engr.

Kingston, N. Y.—The construction of 15,000 ft. 8-24 in. pipe sewers in the Second and Ninth wards and a septic tank disposal system is contemplated. Geo. N. Bell, cy. engr.

Grand Island, Neb.—(Special)—Petitions are being circulated for 6,000 ft. of 8 in. pipe sewers in districts No. 7 and 8, and 1,000 ft. of 15 in. pipe sewers in Locust and Vine-sts. Arnold C. Koenig, cy. engr.

Syracuse, N. Y.—New estimates have been submitted for a sewer in the First ward, reducing the cost from $96,000 to $40,000. It has been recommended that the separate system instead of the combined system be built.

Pendleton, Or.—(Special)—The Pendleton Commercial association is urging council to take action toward securing a sewerage system for this city, and has passed a resolution asking that body to have a preliminary survey made.

Jackson, Mich.—About 2,250 lin. ft. of 60 in brick sewer near line of run, and 1,700 ft. 24 in. brick sewer on Chapin-st. is contemplated; also 1,722 ft. of 15 and 12 in. pipe sewer on Ganson and Cottage-sts. R. M. Newman, cy. engr.

Lebanon, Pa.—The Lebanon Sewerage company has been incorporated to construct and maintain a sewerage system for this city. The incorporators are Samuel Weiss, ex-Judge F. E. Neily, Michael W. Reinochl, ex-Judge John B. Embich, Howard C. Shirk and Harry H. Light.

Galesburg, Ill.—Brick sewers in Cedar Fork creek, N. West-st. and R. R. creek are contemplated, as follows: 2,515 ft. 9x16 ft.; 2,535 ft. 9x15; 4,410 ft. 9x14; 960 ft. 9x12; 1,820 ft. 66 in.; 6,120 ft. 60 in.; 965 ft. 54 in.; 1,115 ft. 48 in.; estimated cost, $300,000. M. J. Blandering, cy. engr.

Fond du Lac, Wis.—(Special)—E. B. Parsons, cy. engr., is preparing plans for a sewerage system for North Fond du Lac, Wis., for the Fond du Lac Land company. The system comprises about 4 mis., of which 1¼ mis. of 20-8 in. pipe sewers will be built this season. No city work is contemplated yet.

Altoona, Pa.—(Special)—The city engineer has been directed to prepare plans and specifications for the disposal of the sewage of the eastern end of the city amounting probably to about 2,000,000 gals. daily. One method of doing this is to convey the East End sewage by means of a tunnel under the city to the present Fourth district intercepting sewer to Sugar run, and thence by a new conduit to the present filter beds.

CONTRACTS AWARDED.

Rochester, N. Y.—H. B. Hooker secured the contract for a sewer in Main-st. E. for $8,900.

Salem, N. J.—The contract for building a sewer in Chestnut-st. has been awarded to J. C. Righter.

Hoboken, N. J.—Charles O'Neil secured the contract for a sewer in Bostwick-ave. at $31,851.

Bar Harbor, Me.—The contract for building a sewer in Eagle Lake road has been awarded to E. W. Hill of Sullivan.

Cincinnati, O.—Thomas P. Strack, has been awarded the contract for a sewer in E. Ridgway-ave. for $1,527.75

Centreville, Mich.—The contract for building one-half mile of sewer has been awarded to Jacob A. Medlem of Goshen, Ind.

Owensboro, Ky.—The contract for building 12 miles of sewers has been awarded to Robert A. Cummings for $15,870.62.

Terre Haute, Ind.—Erler & Peters secured the contract for a sewer in Fourth-st., between Swan and Osborn, for $4,998.

Erie, Pa.—The contract for building a 15 in. tile sewer has been awarded to David Jones at $1.35 per foot for straight pipe.

Hampton, Va.—Guild & Co., Chattanooga, Tenn., secured the contract for building a

sewerage system in Armstead-ave., Queen and King-sts.

St. Paul, Minn.—The contract for building a new storm water sewer on St. Albans-st. has been awarded to Chris Johnson for $5,000.

Martinsville, Ind.—The contract for building sewers has been transferred from J. P. Thompson & Co. of Greensburg to Norton & Gilmore of Terre Haute.

Neenah, Wis.—The contract for building sewer extensions in Second and First districts has been awarded to J. H. Green & Sons of Appleton, for $2,240.

New York City—The contract for building a new sewer to take the place of the Canal-st. sewer has been awarded to the Rapid Transit Subway Construction company.

Chicago, Ill.—The Chicago Star Construction and Dredging company, which had the contract for building the Thirty-ninth-st. intercepting sewer, has abandoned the work and, up to date, the city has been unable to get any contractor or firm of contractors to take the contract.

Dayton, O.—Bids were received April 20 for building sewers in Riverdale district, No. 9, as follows: David A. Ontst, $31,632.12; Ellsworth Brentlinger, $32,393.67; Chas. Hosket, $35,140.45; David Baird, $36,423.06; Myers, Hennessy & Co., $39,523.45; Wagner Water Supply company, $40,904.40.

Scranton, Pa.—(Special.)—Bids were received April 5 for constructing a system of sewers in the Second ward as follows: V. H. O'Hara, Scranton, Pa., $1.49 per lineal foot complete; Dunn & O'Malley, Scranton, Pa., $1.58; Donohoe & O'Boyle, Scranton, Pa., $1.39; P. F. O'Hara, Scranton, Pa., $1.54; C. M. Maynard & Co., Scranton, Pa., $1.67; J. P. Donohoe & Co., Wilkesbarre, Pa., $1.70; J. J. Fahey, Scranton, Pa., $1.35; total length of sewer 3,160 lin. ft; average depth, 7 feet; size, 7 feet; size of pipes, from 8 in. to 24 in. The above prices iunclude the laying of 1,675 lin. feet of house connections, 1 bulkhead, 11 basins and 21 manholes. Bids were received for building a system of sewers in the Seventeenth ward as follows: M. J. Gibbons, Scranton, Pa., $2.18 per lin. ft. complete; J. J. Fahey, Scranton, Pa., $2.13 per lin. ft. complete; J. P. Donohoe & Co., Wilkesbarre, Pa., $2.25 per lin. ft. complete; total length of sewers, 6,700 lineal feet; average depth, 10 feet; size of pipes, from 8 in. to 24 in. The above prices include the laying of 603 lineal feet of house connections, 15 basins and 42 manholes.

WATER-WORKS.

Seymour, Ind.—G. L. McKibben of Van Wert, O., has placed a value of $67,695.65 on the Seymour water works plant.

Scranton, Pa.—The plant of the Providence Gas and Water company has been sold to the Scranton Gas and Water company for $630,000.

Evansville, Ind.—A successful test of the new water works pumping plant was made April 5. The plant has been under course of construction for nearly five years.

Owensboro, Ky.—A temporary injunction against this city has been granted, enjoining it from enforcing the water ordinance. The case will come up for a hearing in June.

CONTEMPLATED WORK.

Linton, Ind.—Water works are proposed.

Boulder, Col.—The water works will be extended.

Madison, Wis.—Specifications are being made for new pumps.

Galesburg, Ill.—An increased water supply is contemplated.

Maysville, N. Y.—The governor has signed the bill authorizing this town to build water works.

Otego, N. Y.—The enlargement of the water works is contemplated. F. B. Cooke, vil. clk.

Watkins, N. Y.—The bill authorizing the town to build water works has been signed by the governor.

Spencer, Mass.—About 1,600 ft. of 16 in. water mains will be laid at a cost of $4,000. N. E. Craig, cy engr.

Geneva, N. Y.—The erection of a new reservoir has been recommended at a cost of about $20,000.

Gloucester, Mass.—An additional source of water supply will be provided for by a loan of $200,000.

The question of issuing water works bonds will be voted on as follows: New Richland, Minn.; Charleston, S. C.

Taunton, Mass.—The sum of $4,000 has been appropriated for an additional pumping engine. Geo. A. King, cy engr.

Cuba, N. Y.—The bill authorizing this town to issue bonds for water works has ben signed by the governor.

Troy, N. Y.—A bill to establish a new water works system at a cost of $1,250,000 has been signed by the governor.

Alton, Ill.—About twenty miles of water mains will be laid for new water plant. E. E. Rutledge, cy. engr.

Joliet, Ill.—About 2,000 ft. of 8 in. water mains will be laid in Ottawa and Joliet-sts. H. A. Stevens, cy. engr.

Amsterdam, N. Y.—(Special.)—The water mains extension to be done will be unknown until after May 1. Francis E. Crane, cy. engr.

Richmond, Va.—An appropriation of $350,000 for building a sedimentation building and a coagulating or secondary basin has been recommended.

Gloucester, Mass.—The city council will vote soon on the question of issuing $200,000 bonds for an additional water supply. W. L. Webber, cy. engr.

The question of issuing water works bonds has been favorably voted on at the following places: Gourie, Ia.; Appleton, Minn.; Blakely, Ga.; Grant's Pass, Ore.

Alton, Ill.—The ordinance creating a board of water commissioners enabling the city to acquire a municipal water works plant, has been signed by the mayor.

Newark, N. J.—Engineer Sherrerd recommended April 12 in connection with the completion of the high service water system, that the 36-in. water main be completed.

Alleghany, Pa.—An ordinance has been recommended instructing Director Robert McAfee to advertise for bids for two 250 h. p. water tube boilers for the Howard-st. pumping station.

Grand Rapids, Mich.—The pure water commission has decided upon Grand river as the source of water supply for the city and a system of filters to purify the supply for domestic use.

Olathe, Kan.—The question of issuing bonds for the enlargment and improvement of the water works system will be voted on May 8. G. B. Alger, pres't coun.; C. F. Garwood, cy. clk.

Evansville, Ind.—The board of water works trustees has decided to employ a competent engineer to investigate conditions and report upon the plan of filtration best adapted to the requirements of the city.

Water mains extensions are contemplated at the following places: Watertown, Wis.; Winnipeg, Man.; Watertown, S. D.; Warren, Ill.; Canandaigua, N. Y.; Columbus, O.; Coshocton, O.; Stockton, Cal.; Portsmouth, N. H.; Saugus, Mass.

Flushing, L. I., N. Y.—Frederick Bowley, president of the borough of Queens, will submit a plan to the board of public improvements for the improvement of the sources of water supply of the Flushing and College Point water system.

St. Louis Mo.—The board of public improvements has appropriated $115,000 additional for the reconstruction of the high service pumping station at Bissel's Point.

and $45,000 additional for the construction and erection of two pumping engines at the Baden station.

Th construction of water works is contemplated at the following places: Van Buren, Ind.; Pomercy, Ia.; Redkey, Ind.; Reedsville, Minn.; Fennemore, Wis.; Lubec, Me.; Pleasantville, Ia.; Cannonsburg, Pa.; Jackson, Ga.; Basin City, Wyo.; Magnolia, Miss.; Clear Lake, S. D.; Cincinnatus, N. Y.; South River, N. J.; Harmony, Pa.; Pepperton, Ga.

CONTRACTS TO BE LET.

Cleveland, O.—Bids are asked until May 17 for furnishing a 20,000,000 gal. pumping engine. W. P. Rice, dir. pub. works.

Vandalia, Ill.—Bids are asked until May 5 for extending the water works. J. R. Schulte, mayor; J. O. Quinn, cy. clk.

Washington, D. C.—Sealed bids are asked until May 5 for completing the Brightwood reservoir. John B. Wright, chmn. dist. com'rs.

Detroit, Mich.—Sealed bids are asked until July 11 for building one or two pumping engines at the water works pumping station. Bd. W. W. Trustees.

Atlantic City, N. J.—Sealed bids are asked until May 8 for furnishing and erecting a water tank of 40,000 gals. capacity and a 50 ft. derrick. Jos. H. Barton, chmn. com.

Cincinnati, O.—Sealed bids are asked until May 8 for the construction, delivering and erection of a deep well pump of 1,000 gals. capacity a minute. Aug. Herrmann, pres t. Bd. Trustees W. W. Com'rs.

CONTRACTS AWARDED.

Carrollton, Mo.—W. F. Harting secured the contract for the extension of the water mains 1,500 ft.

Lebanon, Pa.—The contract for furnishing an additional water supply of 2,500,000 gals. has been awarded to Hawman Bros. of Reading for $77,977.

New Castle, Pa.—The contract for the installation of a water system at the works of the Nation Steel company was awarded to F. R. Dravo & Co. for $50,000.

Reading, Mich.—The contract for a complete water works system has been awarded to T. C. Brooks & Sons of Jackson, Mich. George S. Pierson, M. Am. Soc. C. E., engr.

Peru, Ind.—The Shaw-Kendall Manufacturing company of Toledo, O., secured the contract for changing the water supply of this city from the Wabash river to wells for $35,300.

Cincinnati, O.—Bids were received April 17 for pumping machinery for the water works plant at California, as follows: R. D. Wood & Co. of Philadelphia, for the four pumping engines, $885,000 or $826,000, two plans being submitted with a bid for each plan; one electric traveling crane, $12,000; total of Wood's lower bid, $838,000. Holly Manufacturing company, Lockport, N. Y., for the engines, $1,125,000 or $1,057,000, alternative bids being offered as by the Wood company; for the traveling crane, $6,000; total Holly lower bid, $1,063,000. E. P. Allis & Co., Milwaukee, for the engines, $1,287,500; for the electric traveling crane, $12,500; total Allis bid, $1,300,000. Frisbie Engine and Machinery company, Cincinnati, for the engines, $837,954; for the crane, $15,000; total Frisble bid, $852,954. P. H. and F. M. Roots company, Connersville, Ind., for the engines, $510,000. The last named company put in no bid on the crane. Action on the bids was deferred.

BRIDGES.

Waterbury, S. D.—A county bridge across Crow Creek is contemplated.

Cheyenne, Wyo.—Plans are being prepared for a bridge at Thermopolis.

Joliet, Ill.—(Special.)—A bridge is contemplated at a cost of $15,000. H. A. Stevens, cy. engr.

Rocokford, Ill.—A bridge at a cost of $3,500 is contemplated. Edwin Main, cy. engr.

Lincoln, Neb.—Bids are asked until May 3 for building county bridges during the next year.

Simcoe, Wash.—Plans for a new bridge at this place will be drawn by H. G. Marble, cy. engr.

Decatur, Ind.—(Special.)—Bids will be received May 8 for building six steel bridges. W. E. Fulk, C. E.

Macon, Ga.—The erection of a steel bridge at a cost of $37,000 will begin June 1. J. W. Wilcox, cy. engr.

Medford, Mass.—The erection of a bridge between this town and Somerville is talked of. T. H. Barnes, cy. engr.

Wantonia, Ia.—The taxpayers have vetoed to build a new iron bridge across the millpond; estimated cost, $12,000.

York, Pa.—The Wrought Iron Bridge company, Canton, O., secured the contract to strengthen the College-ave. bridge.

Oneida, N. Y.—A bill has been passed appropriating $15,000 for building a steel bridge over the outlet to Cazenna lake.

Belfast, Me.—Sealed bids are asked until May 7 for building three pile bridges. Lucius H. Murch, cy. clk.

Middletown, O.—Sealed bids are asked until May 15 for a hoist bridge over the canal on Tytus-ave. L. A. Dillon, co. engr.

Wichita, Kas.—The county commissioners have authorized the building of four small steel bridges in various parts of the county.

New Castle, Ind.—Sealed bids will be received until May 8 for seven steel bridges. John W. Whitworth, chrmn. bd. co. comrs.

Auburn, N. Y.—City Engineer Austin has been directed to prepare plans for a steel bridge over the Owasco river at Lizette-st.

Brookhaven, Miss.—The contract for building a bridge across Topisaw creek will be sold at public outcry May 1. R. W. McNair, clk. bo. supvrs.

Davisville, Cal.—Plans and specifications are being made for a bridge over Putah creek, to be submitted to the board of supervisors May 10. W. O. Russell, co. surv.

Cincinnati, O.—Sealed bids are asked until May 4 for the superstructure of a steel truss bridge to convert the intake pier with the Kentucky shore of the Ohio river, near California. Aug Herrmann, prest. bd. trustees W. W. com'ns.

Chicago, Ill.—Sealed bids are asked until May 15 for building a movable bridge over the Calumet river at Ninety-fifth-st., and until June 1 for a movable highway bridge over the North Branch canal at Division-st. L. E. McGann, com'n pub. works.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Kewanee, Ill.—Council has decided to purchase a street sweeper.

Cohoes, N. Y.—The question of cleaning the paved streets is being discussed.

Detroit, Mich.—The council has appropriated $75,000 for the garbage disposal fund.

Altoona, Pa.—The purchase of a garbage crematory is proposed. Harvey Linton, cy. engr.

Fresno, Cal.—Bids will be advertised for furnishing three sprinkling wagons. Louis Manuel, cy. engr.

West Chester, Pa.—Immediate steps will be taken towards the construction of a garbage disposal plant.

Belleville, N. J.—The question of garbage disposal is being considered by the Belleville township committee.

Chicago, Ill.—Council has made an appropriation of $1,061,655 for street-cleaning for the remainder of this year.

Hastings, N. Y.—The village board has decided to have the ashes, garbage, etc., removed by contract this yaer.

Philadelphia, Pa.—The contract for street sprinkling has been awarded to David McMahon of Germantown, Pa., for $5,000.

Houghton, Mich.—The health committee has been authorized to secure plans and estimates for a garbage crematory.

Winnipeg, Man.—Bids are asked until May 15 for furnishing and erecting a garbage crematory. H. N. Ruttan, cy. engr.; C. J. Brown, cy. clk.

Alleghany, Pa.—J. R. Murphy, director department public safety, has been directed to ask for bids for removing the garbage in the city for the next four years. A crematory will probably be built.

Indianapolis, Ind.—Bids were received April 16 for sprinkling in six districts, but all of the bids were rejected, except one, that of Geo. W. McCray, for sprinkling in the Sixth district, at $21.90 per square of 10,000 ft. for two sprinklings a day, and $22.90 for three sprinklings a day. New bids will be advertised for the other districts.

Bangor, Me.—The water board is considering refuse disposal and may build crematories. Some action will probably be taken during May. Address Walter I. Brown, clk. water board.

STREET LIGHTING.

Cedarville, N. J.—The construction of a gas plant is contemplated.

Houston, Tex.—Contracts for a lighting plant are being advertised for.

New Albany, Ind.—The New Albany Light and Water company has been granted a franchise.

Tarboro, N. C.—The contract for erecting an electric light plant was awarded to E. J. Rose & Co.

Louisville, Ky.—The Louisville Gas company has proposed to the city to reduce the price of gas to $1.

The question of issuing bonds for electric light plants will be voted on at Alameda, Cal.

Wilmington, N. C.—Bids are asked until May 7 for lighting the city. A. M. Waddell, mayor.

Thomaston, Ga.—The council is desirous of letting a contract for a lighting plant. Thad. Adams, clk.

Marion, Ind.—Bids will be asked in May for an electric light plant. W. E. McDonald, mgr. Marion Electric company.

Lowellville, O.—The contract for building the electric light plant was awarded to D. E. Hamilton and Dickson McBride.

Grand Island, Neb.—(Special.)—The city council is discussing the question of installing its own electric light plant in the water works station.

Palatka, Fla.—Bids are being asked for furnishing this city with 17-2,000 c. p. arc and 102 32 c. p. incandescent lights. T. B. Anderson, cy. clk.

Toronto, Ont.—Bids are asked until June 1 for lighting the city and furnishing it with power for five or ten years. E. A. McDonald, chmn. bd.

Electric light plants are contemplated at the following places: Shakopee, Minn.; New Wilmington, Pa.; St. Michaels, Md.; Callettsville, Tex.; Brockville, Ont.

Dayton, O.—The Dayton Eectric Light company is reported as having received the contract for lighting the city by electricity for ten years at $60.50 per light per year.

The question of issuing electric light bonds has been favorably voted on as follows: Carlyle, Ill.; Ilion, N. Y.; Blakely, Ga.; Appleton, Wis.; Grant's Pass, Or.; Galena, Ill.; Harmony Grove, Pa.; Union City, Mich.

Waterbury, Vt.—The consolidated Electric Light company of Montpelier secured the contract for furnishing 100 or more 32 c. p. incandescent and two 2,000 c. p. arc lights for five years at $6 and $50 per year, respectively.

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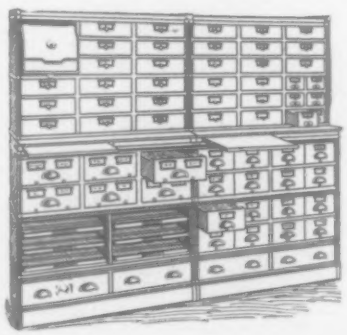

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